



October 1<sup>st</sup>, 2020

**Re: AAT ARV Compliance Testing**

Ron Kramer  
Process Manager – Long Island Sterilization  
Long Island Sterilization  
175 Wireless Boulevard  
Hauppauge, New York 11788  
631-435-4711

Dear Mr. Kramer:

Attached is one copy of the test report for the above referenced testing program. We understand that you will submit the required copies of the protocol to the New York State Department of Environmental Conservation for review. Should there be any questions concerning the enclosed protocol, please contact me at (484) 252-4335.

Respectfully,

*L. Christopher Heilner*

L. Christopher Heilner, QSTI  
Owner, LCH Consulting Associates, LLC

**NYSDEC Permit 1-4734-00743/00006  
Compliance Test Report**

**2020 Compliance Test of Advanced Air Technology Safe Cell II Model  
DR490A Dry Bed Reactive Scrubber for the Emissions Control of Aeration  
Room Vent**

**Long Island Sterilization**  
175 Wireless Boulevard  
Hauppauge, New York, 11788

**October 1<sup>st</sup>, 2020**

**Prepared for:**

Ron Kramer  
Process Manager  
Long Island Sterilization  
175 Wireless Boulevard  
Hauppauge, New York 11788

**For submittal to:**

Ms. Nahla Babiker  
Environmental Engineer  
New York State Department of Environmental Conservation – Region 1  
Division of Air Resources  
SUNY at Stony Brook  
50 Circle Road  
Stony Brook, New York 11790

**Prepared by:**

L. Christopher Heilner  
Owner  
LCH Consulting Associates, LLC  
88 Glocker Way PMB 287  
Pottstown, Pennsylvania 19465

## TABLE OF CONTENTS

<b>DESCRIPTION</b>	<b>PAGE</b>
<b>1.0 EXECUTIVE SUMMARY .....</b>	<b>4</b>
1.1 CONTACT SUMMARY .....	4
1.2 PERMIT AND SOURCE SUMMARY .....	5
1.2.1 <i>Applicable Regulation – 40CFR63.360 Subpart O: Ethylene Oxide Emissions Standards for Sterilization Facilities</i> .....	5
<b>2.0 PROCESS DESCRIPTION .....</b>	<b>6</b>
<b>3.0 SCOPE AND OBJECTIVES .....</b>	<b>7</b>
<b>4.0 FIELD TESTING PROGRAM .....</b>	<b>8</b>
4.1 TESTING LOCATION AND SAMPLING POINTS .....	8
4.2 TESTING SUMMARY .....	8
4.2.1 <i>Minimum Test Durations and Sample Volumes</i> .....	8
4.3 PROCESS OPERATIONS AND EMISSION TESTING .....	9
4.4 SAMPLING PROCEDURES .....	9
4.4.1 <i>Determination of Ethylene Oxide Emissions</i> .....	9
4.5 SAMPLE ANALYSES .....	11
4.5.1 <i>GC Description</i> .....	11
4.5.2 <i>Calibration Standards</i> .....	11
4.5.3 <i>Chromatograms</i> .....	11
4.5.4 <i>QA/QC Measures</i> .....	12
<b>5.0 DATA EVALUATION AND REPORT PREPARATION .....</b>	<b>13</b>
5.1 EMISSION CALCULATIONS .....	13
5.2 REPORT PREPARATION .....	13

## TABLES

---

Table 1 Test Methodology Summary .....	Page 6
Table 2 Allowable Limits .....	Page 7
Table 3 Test Durations.....	Page 8

## ATTACHMENTS

---

Emission Calculations .....	Attachment A
Chromatogram Logsheet .....	Attachment B
Chromatograms .....	Attachment C
Emission Spreadsheets .....	Attachment D
Q/A Q/C Calibration Records .....	Attachment E

## **CERTIFICATION OF ACCURACY AND COMPLETION**

I, Mr. L. Christopher Heilner, as the LCH Consulting Associates report author, certify under penalty of law that I believe the information provided in this document is true, accurate and complete. I am aware that there are significant civil and criminal penalties, including the possibility of fine or imprisonment, or both, for submitting false, inaccurate, or incomplete information.

Signed: *L. Christopher Heilner* Date: 10/01/20

L. Christopher Heilner  
Owner  
LCH Consulting Associates  
Telephone: (484) 252-4335

## **1.0 EXECUTIVE SUMMARY**

Long Island Sterilization (LIS) is a commercial ethylene oxide sterilization facility located in Hauppauge, New York 11788. LIS has retained LCH Consulting Services, LLC (LCH) of Pottstown, Pennsylvania to prepare this protocol and perform the subsequent testing. The LSI operation includes two sterilization chambers (permitted for three) and one aeration room. This protocol aims to satisfy the compliance testing requirements as required by United States Environmental Protection Agency 40 CFR 63 Subpart O and New York State Department of Environmental Conservation permit ID 1-473734-00743/00006.

### **1.1 CONTACT SUMMARY**

#### **Facility (LIS) Responsible Official**

Ron Kramer  
Process Manager  
Long Island Sterilization  
175 Wireless Boulevard  
Hauppauge, New York 11788  
631-435-4711  
[rkramer@busseinc.com](mailto:rkramer@busseinc.com)

#### **Regulatory Agency (NYDEC) Contact**

Ms. Nahla Babiker  
Environmental Engineer  
New York State Department of Environmental Conservation – Region 1  
Division of Air Resources  
SUNY at Stony Brook  
50 Circle Road  
Stony Brook, New York 11790  
631-444-0239

#### **Stack Test Contractor**

Mr. L. Christopher Heilner  
Owner  
LCH Consulting Services, LLC  
88 Glocker Way PMB 287  
Pottstown, PA 19465  
484-252-4335 phone  
[chris@lchconsulting.com](mailto:chris@lchconsulting.com)

## 1.2 PERMIT AND SOURCE SUMMARY

### **1.2.1 Applicable Regulation – 40CFR63.360 Subpart O: Ethylene Oxide Emissions Standards for Sterilization Facilities**

*NYSDEC Permit Number – 1-4734-0074/00006*

*Facility DEC ID Number - 147340074*

2.1 *Process Description* – Ethylene Oxide Commercial Sterilization Facility, comprising; two sterilization chambers to pre-condition and sterilize product, one aeration room, one Damas wet gas scrubber one (Include the Anguil Model 30 Catalytic Oxidizer) Advanced Air Technology Safe Cell dry bed reactive scrubber.

*Sterilization Chamber Description* – 2 Environmental Techtonics chambers, No. 1, and 2; each of twelve pallet, 1685 cubic foot construction using approximately 50 to 75 pounds of Ethylene Oxide per cycle. *Heated Aeration Room Description* – 49' in width and 39'9" in length. The height to the hung ceiling is approximately 21' 2" with 108 pallet capacity, situated in line with chamber No. 1 and No. 2. However, maximum normal operating capacity (MNOC) is between 48 and 60 pallets.

A Damas Wet Gas Acid/Water Scrubber is used to control sterilization chamber vent (SCV) emissions. By EPA Subpart O standards, the scrubber is held to 99.0% ethylene oxide removal efficiency. This was proved July 11, 2019 by stack testing. This protocol excludes any testing of the sterilization chamber vents (SCV) or the Damas wet gas Acid/Water Scrubber air pollution control device (APCD).

An Advanced Air Technology Safe Cell Model DR-490A (AAT) dry bed reactive scrubber has been added to prefilter before being introduced to the Anguil Model 30 Catalytic Oxidizer to control aeration room vent (ARV) emissions. By EPA Subpart O standards, this APCD is held to less than 1ppm of ethylene oxide emissions or 99.0% removal efficiency.

*Stack Test Summary* – Three sixty minute test runs was conducted on the outlet of the AAT APCD controlling ARV emissions. The aeration room was at 90% or greater of maximum pallet capacity. The pallets were in aeration for a period of sixty prior to beginning the first test run. The average sixty minute concentration was determined by onsite Gas Chromatography Flame Ionization Detection (GCFID). The average off all three test runs was used to compare to applicable limits (<1ppm).

The following are the proposed test methods to be used:

USEPA Method 18 – Volatile Organic Compound Determination by Gas Chromatograph

USEPA Methods 1,2,3 and 4 – Determination of Volumetric Flow and Moisture Content of Stack Gas

Subpart O 40CFR63.365 (c) (2) – Calculations

Test Date – September 17<sup>th</sup>, 2020

*Compliance Summary* – According to page 7 of NYDEC Permit ID 1-4734-00743/00006, Condition 1 of USEPA 40CFR §63.362 item 1.2 the ARV shall be limited to less than 1ppm ethylene oxide or greater than 99.0% ethylene oxide removal efficiency.

**TABLE 1**  
**Testing Methodology Summary**

Parameter	EPA Method	Comment
Volumetric Flow Rate Determinations	1, 2, 3, 4	Methods 1, 2, 3 and 4 were used to determine volumetric flow rates through the AAT. A standard pitot tube was used to determine velocity heads. A molecular weight of 29.00 was assigned to the stack gas as it is essentially ambient air. Wet bulb and dry bulb measurements were made to determine saturated moisture content of the stack gas.
Ethylene Oxide	18	Onsite gas chromatography flame ionization detection (GCFID) was used to determine ethylene oxide concentrations nearly during the test program. The samples were collected in Teflon sample bags and transported immediately to the GC for analysis. Method appropriate calibration curves and QA/QC measures were determined and performed onsite before and upon completion of the sampling event.

## **2.0 PROCESS DESCRIPTION**

LIS operates two sterilization chambers and the associated sterilization operation. This includes the aeration room. Aeration is an essential part of LIS validated sterilization cycle for specific customer products. The purpose of aeration is to reduce or eliminate ethylene oxide concentrations retained by sterilized product thus making it safe and healthful to be handled. LIS has a heated aeration room with a floor space of 49' in width and 39'9" in length and a maximum normal operating capacity (MNOC) of 48 to 60 pallets. At the time of the test, there were 72 pallets that went into aeration at 0630 on the morning of September 17<sup>th</sup>, 2020. The emissions from this aeration room, combined with fugitive vent streams from the sterilization chamber areas are ducted directly into an AAT dry bed reactive scrubber APCD prior to being introduced to the Anguil Model 30 Catalytic Oxidizer. The AAT is a passive means of controlling reactive gases by



adsorbing the ethylene oxide over small proprietary beads housed in stainless steel chambers designed to achieve appropriate retention and exposure of the reactive gases to the surface area of each bead. These beads are considered the media. The AAT operates at ambient conditions and has air forced to from the aeration room vent through each AAT chambers. Each chamber of the AAT has a differential pressure gauge to monitor proper air flow through the AAT.

### **3.0 SCOPE AND OBJECTIVES**

The objective of the testing program was to satisfy the NYDEC Permit ID 1-4734-00743/00006 initial and ongoing compliance testing requirements and to determine compliance with regards to applicable permit allowable limits. Allowable permit limits are summarized on the following page in Table 2. The stack test will consist of three sixty minute test runs will; the average of the three was compared against allowable limits for determination permit compliance.

**TABLE 2**  
**Allowable Limit**

<b>Emission Parameter</b>	<b>Allowable Limit</b>
ARV Emissions	Less than 1ppm or greater than 99.0% removal efficiency

**TABLE 3 Results of Compliance Testing**

<b>Date</b>	<b>Time</b>	<b>Test ID</b>	<b>Ethylene Oxide <math>ppm_{vd}</math></b>	<b>Destruction Removal Efficiency (%)</b>	<b>Ethylene Oxide <math>lbs/hr</math></b>	<b>Destruction Removal Efficiency (%)</b>
09/17/20	0815-0915	Run 1 AAT Inlet	54.0	98.60%	0.442	98.60%
		Run 1 AAT Outlet	0.8		0.006	
09/17/20	0920-1020	Run 2 AAT Inlet	44.8	99.35%	0.367	99.41%
		Run 2 AAT Outlet	0.3		0.002	
09/17/20	1025-1125	Run 3 AAT Inlet	36.7	100.00%	0.300	100.00%
		Run 3 AAT Outlet	0.0		0.000	
09/17/20	0815-1125	Average AAT Inlet	45.2	99.32%	0.370	99.32%
		Average AAT Outlet	0.3		0.003	

## **4.0 FIELD TESTING PROGRAM**

### **4.1 Testing Location and Sampling Points**

Sampling for the ARV was conducted at the outlet of the AAT stack approximately twelve feet above ground. The outlet stack is fourteen inches in diameter. The location was accessed via ladder. One port was used, placing a stainless steel probe in the centroid of the stack to conduct the sample gas to the collection method. LCH determine removal efficiency on both a ppm and lbs/hr basis. But at a minimum, the less than one ppm compliance parameter was met.

### **4.2 Testing Summary**

Testing was conducted according to the U.S. EPA Federal Register 40 CFR 60 Appendix A. The following procedures were utilized at the AAT exhaust stack.

#### **Procedures<sup>1</sup>**

Method 18: Volatile Organic Compounds by Gas Chromatography  
Methods 1-4: Volumetric Flow Rate Determinations

Three test runs were performed for each emission parameter.

The average of the three test runs was compared to the allowable emission limits to determine compliance.

Detailed descriptions of the sampling trains, analyzers, and procedures are provided in Section 4.4.

#### **4.2.1 Minimum Test Durations and Sample Volumes**

Based on previous testing procedures, and analytical and emission results, test runs will have minimum durations and collect approximate sample volumes as specified in the following table.

---

<sup>1</sup>Source: U.S. EPA, *Federal Register*, Title 40 Part 60, Appendix A

**Table 4**  
**Minimum Test Duration**

Emission Parameter	EPA Method(s)	Minimum Test Duration (minutes)	Approximate Sample Volume
Ethylene Oxide	18 (Subpart O)	Starting one hour after the aeration has been filled to >90% MNOC capacity, three sixty minute sample runs was conducted.	60 minutes at 0.25 – 0.5 LPM for an average sample volume of 20-25 liters per run.

### 4.3 Process Operations and Emission Testing

During each sample run the following process data was confirmed

1. Number of pallets in aeration was 72
2. Differential pressure across all AAT chambers was 4.5”H<sub>2</sub>O
3. AAT inlet temperature was 100-110°F

### 4.4 SAMPLING PROCEDURES

The following sections provide descriptions of sampling procedures and the sampling trains that were used for emissions testing.

#### 4.4.1 Determination of Ethylene Oxide Emissions

Procedures outlined in 40 CFR 60 Methods 18 and Subpart O 40CFR63.365 (b) calculations were used to determine ethylene oxide emission concentrations, and are discussed as follows:

AAT outlet ETO samples were collected in Teflon sample bags for a period of sixty minutes as per USEPA Method 18 section 8.2.1. An evacuated canister was used to draw the sample into a sample bag through an unheated stainless steel probe and Teflon transport line. Prior to sampling both the evacuated canister and the sample bag was leak checked. A sample rate of approximately 0.25 – 0.5 liters per minute was established to fill the sample bag.

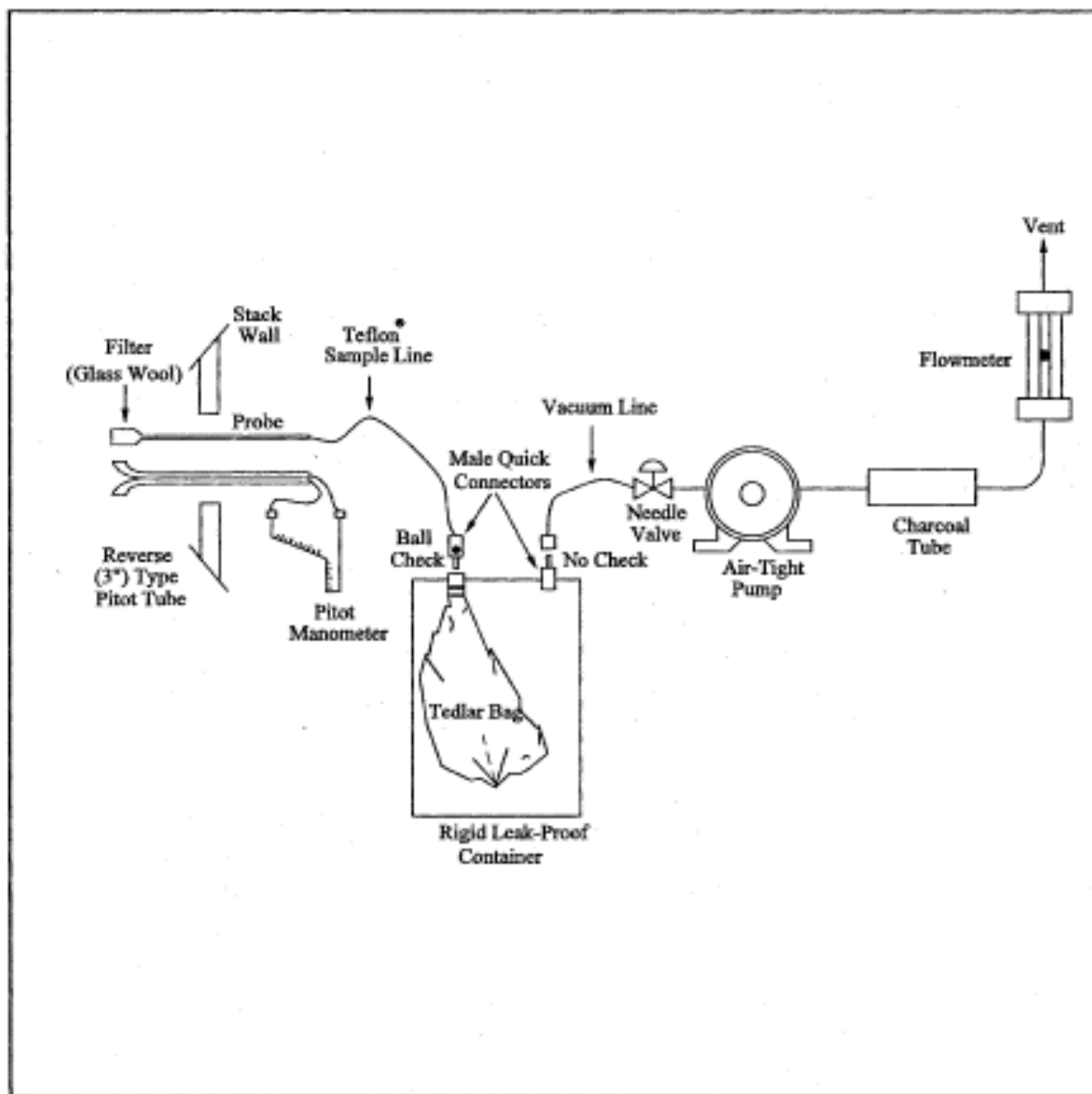


Figure 18-9. Integrated Bag Sampling Train.

After the first sample bag is collected and analyzed, the sample was used to perform a recovery study. The sample bag was spiked with the mid-range calibration gas and reanalyzed. The bag will then be rested for a period of sixty minutes or greater. After the rest period the bag was reanalyzed. The initial and the aged sample bag must agree within 30% to consider the samples valid. The results of the recovery study are available in Attachment E.

## **4.5 SAMPLE ANALYSES**

All samples were onsite by an experienced LCH technician operating a GC FID. All QA/QC measures inherit to the analyzer and the methodology was followed.

### **4.5.1 GC Description**

Samples were analyzed by gas chromatography using an SRI 8610C gas chromatograph with dual column, dual detector (PID and FID) with heated sample loops, injectors and 3 meter packed columns. Gas in the sample loop is injected directly into the GC's analytical columns by the gas sampling valve. The GC was operated with carrier gas pressure of 18psi and column temperature of 130°C. The carrier gas is ultra-high purity helium. Ultra-high purity hydrogen and air are used to maintain the FID. ETO eluted at 0.9-1.0 minutes.

### **4.5.2 Calibration Standards**

Four cylinders of calibration standard, ETO in nitrogen, in concentrations of 1.05, 5.1, 10.1, and 100.6 ppm was used to create a calibration curve to calculate ETO concentration in ppm given instrument response in millivolts. Calibration standards were analyzed in triplicate and the average value of the samples was calculated. An analytical result is considered valid if its value is within 5% of the average value of the three analyses. Results of the calibration gas analyses were compared to the certified value of the calibration gas.

A calibration curve was generated using Microsoft Excel chart function by constructing a linear XY-Scatter graph that solves the quadratic equation of the line  $Y=mX+b$  where "y" is the calculated concentration of EtO, "x" is the instrument response, "m" is the constant and "b" is the y-coordinate intercept. The option forcing the graph through zero was enabled so "b" = zero. The least squares  $R^2$  value and the equation of the line were shown. An  $R^2$  value of 95% is acceptable according to Method 18. The gas chromatograph routinely exceeds the 95%  $R^2$  value. The calibration curves are available in Attachment A.

### **4.5.3 Chromatograms**

The chromatogram log sheet is a Microsoft Excel spreadsheet that transposes run information in an easy to read format and provides the calculating capabilities to assess the QA/QC requirements of the method. The chromatograms are logged by the file path directory of the hard drive storage. The chromatogram logsheet is available in Attachment B.

The chromatograms are automatically printed at the conclusion of each analysis in .pdf format. Each chromatogram includes information identifying the type of analysis, i.e. set up, calibration, sample, recovery study, date and time of analysis, comments, retention time and integrated peak area. The results are in units

of millivolts. Field corrections, if necessary, were initiated by the operator. The chromatograms are available in Attachment C.

#### **4.5.4 QA/QC Measures**

##### **4.5.4.1 Calibration Drift Assessment**

The mid-range calibration standard was analyzed at the conclusion of testing and the results were compared to the initial analysis to determine if calibration drift has occurred. A 5% deviation between results is allowable. Should excessive calibration drift be observed all calibration standards was re-analyzed and a new calibration curve using all the pre-test and post-test data was generated following the procedures of Method 18. The SRI gas chromatograph met the 5% criteria. The results of the calibration drift test are available in Attachment E.

##### **4.5.4.2 Bag Sampling Recovery Study**

If the procedures for the bag sampling and analysis in section 8.2.1 are followed the following procedure was used. After analyzing all three bag samples, one of the bag samples was chosen and tagged as the spiked bag. The chosen bag sample was spiked with a known mixture (gaseous or liquid) of all the target pollutants. The theoretical concentration, in ppm, of each spiked compound in the bag shall be 40 to 60 percent of the average concentration measured in the three bag samples. If a target compound is not detected in the bag samples, the concentration of that compound to be spiked shall be 5 times the limit of detection for that compound. The spiked bag was stored for the same period as the bag samples collected in the field. After the appropriate storage time has passed, the spiked bag was analyzed three times. The average fraction recovered (R) of each spiked target compound was calculated with the equation in section 12.7 of Method 18.

For the bag sampling technique to be considered valid for a compound,  $0.70 \leq R \leq 1.30$ . If the R value does not meet this criterion for a target compound, the sampling technique is not acceptable for that compound, and therefore another sampling technique shall be evaluated for acceptance (by repeating the recovery study with another sampling technique). Report the R value in the test report and correct all field measurements with the calculated R value for that compound by using the equation in section 12.8. LCH intends to use Teflon sample bags in lieu of Tedlar sample bags because of the superior results found in recovery studies. The results of the Sample Recovery Study are available in Attachment E.

## **5.0 DATA EVALUATION AND REPORT PREPARATION**

### **5.1 EMISSION CALCULATIONS**

The destruction removal efficiency is calculated using the mass of ETO evacuated from the chamber and the mass at the outlet of the abator. The mass of ETO at the inlet of the balance was calculated following the procedures of Subpart O section 63.365(b). However, LCH does not anticipate the need to demonstrate DRE as the less than 1ppm compliance criteria is less stringent. Emissions calculations are included in attachment A.

Emissions were calculated according to the appropriate EPA methodologies.

### **5.2 REPORT PREPARATION**

Testing and pertinent operating data was reviewed by Long Island Sterilization to prepare a full comprehensive test report, including but not limited to, the following:

# **ATTACHMENT A**

## **EQUATIONS**



**Equation 1: Outlet EtO concentrations**

$$W_o = (Q * \text{Mol.Wt.} * C) / (10^6 * \text{Mol.Vol.})$$

**Where:**

<b>W<sub>o</sub></b>	=	<b>Mass of EtO released from abator to atmosphere</b>
<b>Q</b>	=	<b>Total volume of gas at the outlet of the abator (scf)</b>
<b>Mol.Wt.</b>	=	<b>Molecular Weight of ETO 44.05 (lb/lb-mol)</b>
<b>C</b>	=	<b>Concentration EtO in sample (ppmv)</b>
<b>Mol.Vol.</b>	=	<b>Molar volume: 385.32 scf/lb-mol at STP</b>
<b>10<sup>6</sup></b>	=	<b>Conversation factor for parts per million</b>

**Equation 2: Mass Emission Rates**

$$Q = t * (1 - B_{ws}) * V_s * A * ((T_{std} * P_s) / (T_s * P_{std}))$$

**Where:**

<b>T</b>	=	<b>Duration of test in minutes</b>
<b>B<sub>ws</sub></b>	=	<b>Water vapor proportion by volume</b>
<b>V<sub>s</sub></b>	=	<b>Stack gas velocity in feet per second</b>
<b>A</b>	=	<b>Cross-sectional area of the stack in SQFT</b>
<b>T<sub>std</sub></b>	=	<b>528(°R) - standard temperature</b>
<b>P<sub>s</sub></b>	=	<b>Absolute stack Pressure ("Hg)</b>
<b>T<sub>s</sub></b>	=	<b>Stack Temperature (°R)</b>
<b>P<sub>std</sub></b>	=	<b>29.92"Hg - standard pressure</b>

**Equation 3: Destruction/Removal Efficiency**

$$DRE = [(W_i - W_o) / W_i] * 100$$

**Where:**

<b>W<sub>i</sub></b>	=	<b>Mass of EtO at inlet of balance, Subpart O Calculation</b>
<b>W<sub>o</sub></b>	=	<b>Mass of EtO at outlet of the abator</b>

**ATTACHMENT B**  
**CHROMATOGRAM LOGSHEET**

Long Island Sterilization, Hauppague, New York								
AAT Dry Bed Scrubber Evaluation								
Date	fp	type	description	retention time	response	average	score	calc'd conc
09/17/20	4	cal	100.6ppm Calibration Gas	0.993	517.4	517.77	1.00	100.5
	5			1.003	518.3		1.00	
	6			0.990	517.7		1.00	
09/17/20	14	cal	10.1ppm Calibration Gas	0.990	57.4	57.24	1.00	10.8
	15			1.000	57.0		1.00	
	16			1.003	57.4		1.00	
09/17/20	23	cal	5.1ppm Calibration Gas	0.986	23.1	22.94	1.01	4.3
	24			1.000	22.8		1.00	
	25			1.000	22.8		0.99	
09/17/20	31	cal	1.05ppm Calibration Gas	0.986	7.8	7.88	1.00	1.4
	32			1.000	7.9		1.00	
	33			1.000	7.9		1.00	
09/17/20	41	Sample	AAT Outlet Run 1	1.006	4.0	4.11	0.98	0.8
	42			1.023	4.2		1.01	
	43			1.010	4.1		1.01	
09/17/20	46	Sample	AAT Outlet Run 1 RS Initial	1.000	12.1	12.06	1.00	2.2
	47			1.003	12.2		1.01	
	48			0.990	11.9		0.99	
09/17/20	51	Sample	AAT Inlet Run 1	0.986	277.0	278.48	0.99	54.0
	52			1.060	280.1		1.01	
	53			1.003	278.3		1.00	
09/17/20	58	Sample	AAT Inlet Run 2	0.990	230.0	230.65	1.00	44.8
	59			1.003	231.2		1.00	
	60			1.003	230.8		1.00	
09/17/20	64	Sample	AAT Outlet Run 2	1.006	4.8	1.61	3.00	0.3
	65			NA	0.0		0.00	
	66			NA	0.0		0.00	
09/17/20	71	Sample	AAT Outlet Run 1 RS Aged	1.003	12.4	12.40	1.00	2.3
	72			0.993	12.2		0.99	
	73			1.006	12.6		1.02	
09/17/20	75	Sample	AAT Outlet Run 3	NA	0.0	0.00		0.0
	76			NA	0.0			
	77			NA	0.0			
09/17/20	81	Sample	AAT Inlet Run 3	0.996	185.0	187.29	0.99	36.7
	82			1.010	187.8		1.00	
	83			1.006	189.1		1.01	
09/17/20	88	Sample	5.1ppm Calibration Drift Test	1.000	22.4	22.14	1.01	4.1
	89			0.873	22.4		1.01	
	90			0.843	21.7		0.98	

Date	Time	Test ID	Ethylene Oxide <i>ppm<sub>vd</sub></i>	Destruction Removal Efficiency (%)	Ethylene Oxide <i>lbs/hr</i>	Destruction Removal Efficiency (%)
09/17/20	0815-0915	Run 1 AAT Inlet	54.0	98.60%	0.442	98.60%
		Run 1 AAT Outlet	0.8		0.006	
09/17/20	0815-0915	Run 2 AAT Inlet	44.8	99.35%	0.367	99.41%
		Run 2 AAT Outlet	0.3		0.002	
09/17/20	0815-0915	Run 3 AAT Inlet	36.7	100.00%	0.300	100.00%
		Run 3 AAT Outlet	0.0		0.000	
09/17/20	0815-0915	Average AAT Inlet	45.2	99.32%	0.370	99.32%
		Average AAT Outlet	0.3		0.003	

**ATTACHMENT C**  
**CHROMATOGRAMS**

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 05:44:15

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

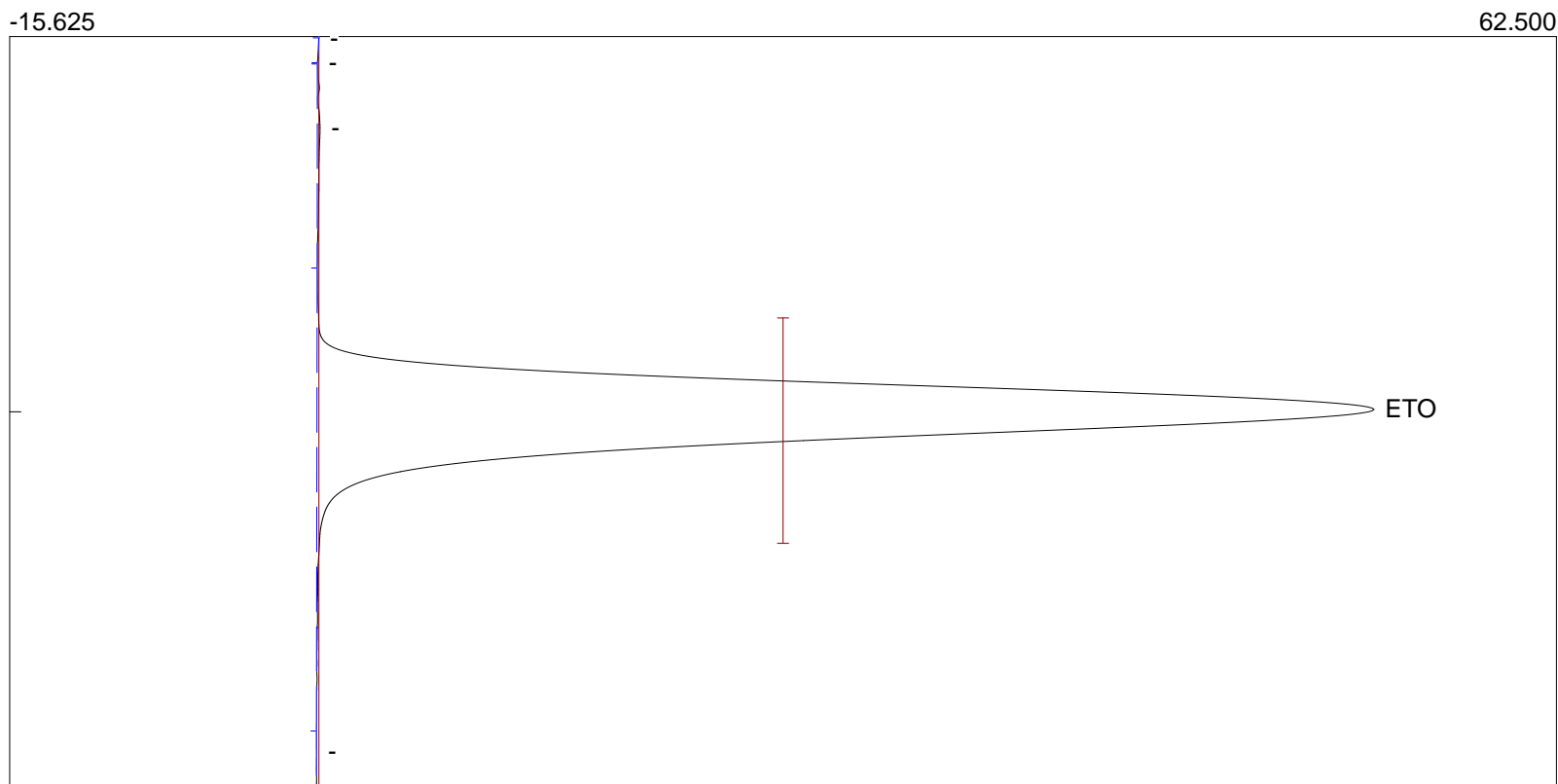
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_04. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 100.6ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.993	517.3612
1			517.3612

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 05:46:22

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

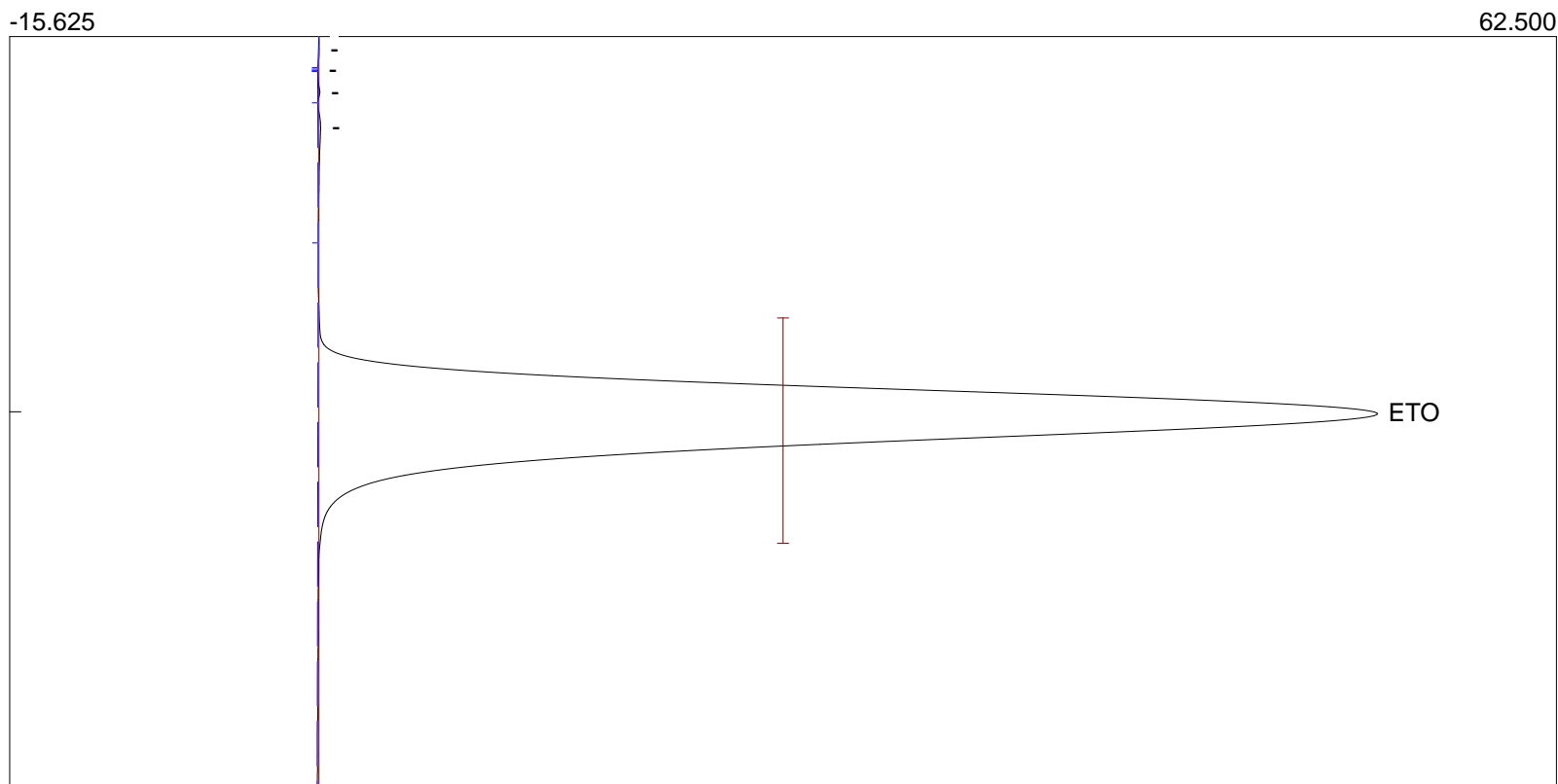
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_05. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 100.6ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.003	518.3040
1			518.3040

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 05:48:26

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

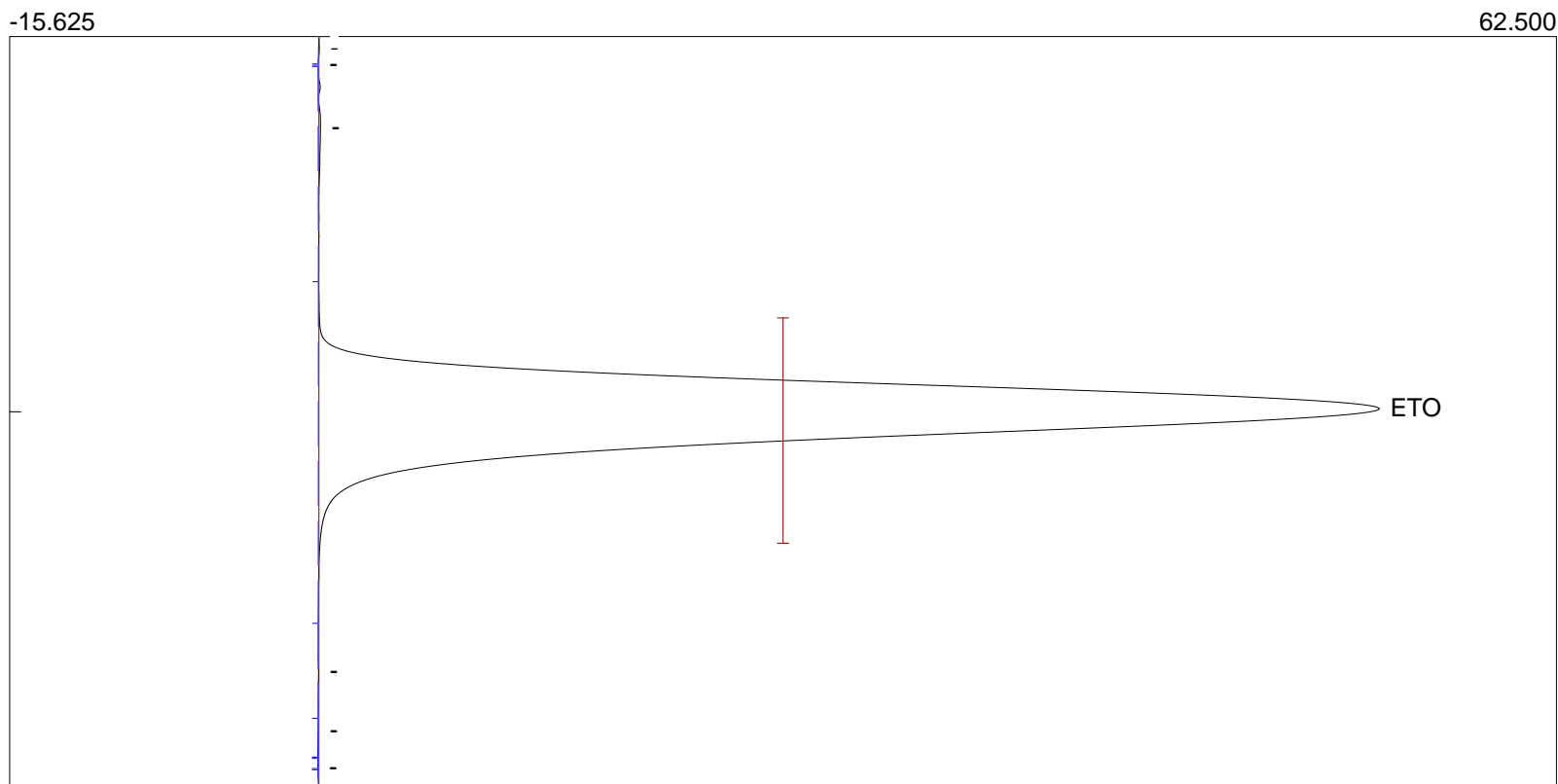
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_06. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 100.6ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.990	517.6551
1			517.6551

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:04:52

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

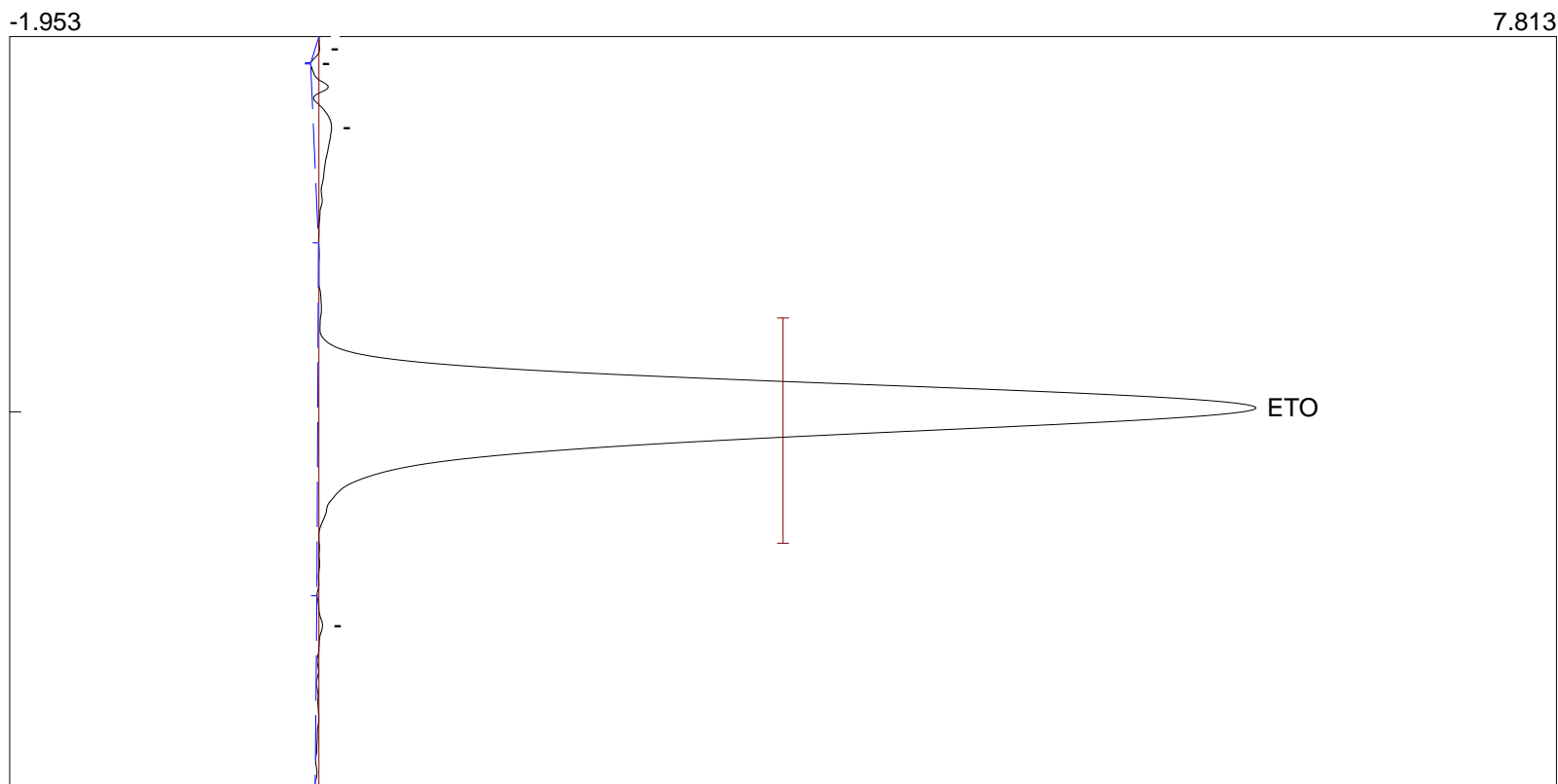
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_14. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 10.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.990	57.4082
1			57.4082



Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:06:56

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

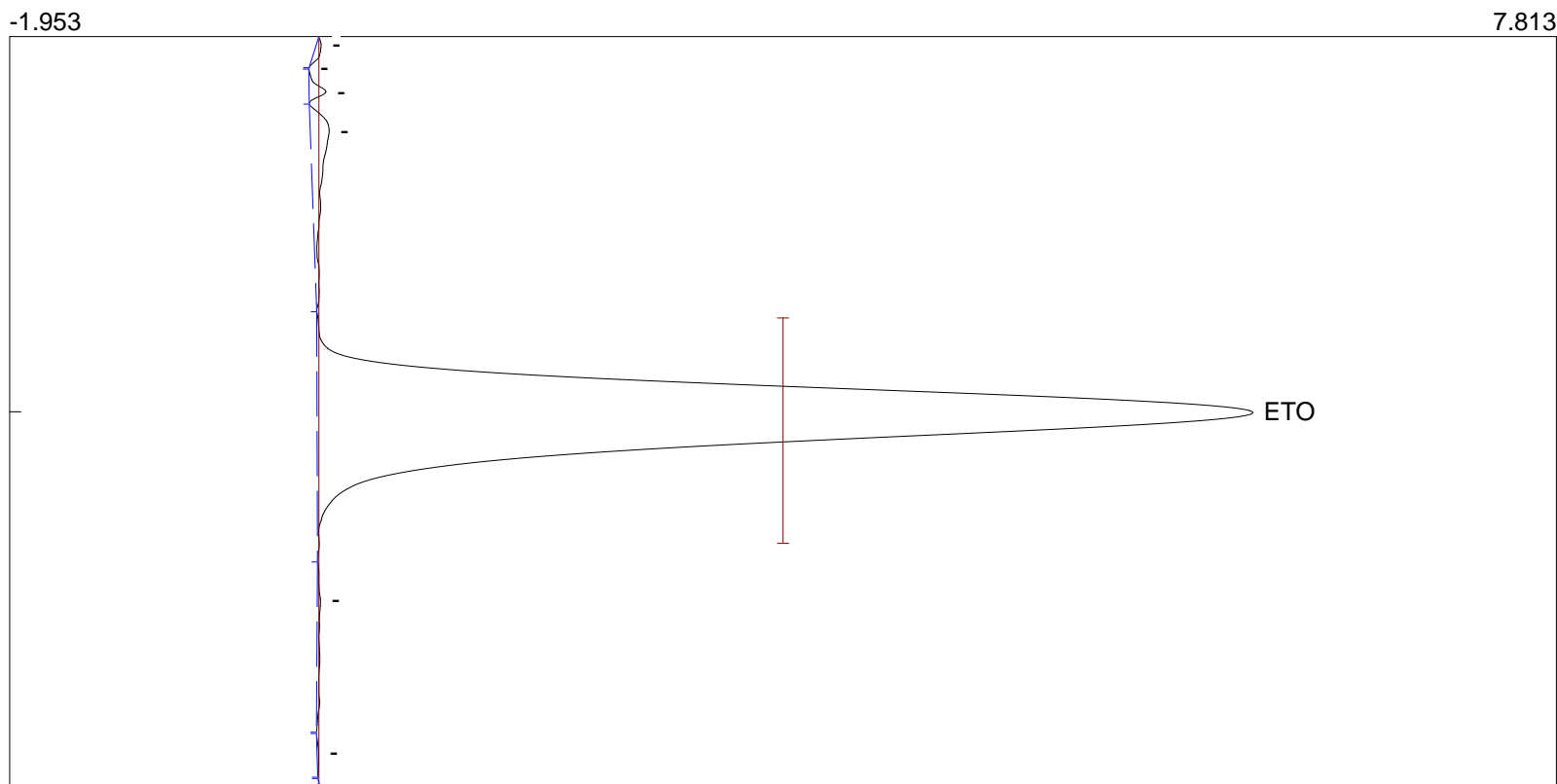
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_15. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 10.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.000	56.9678
1			56.9678

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:09:04

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

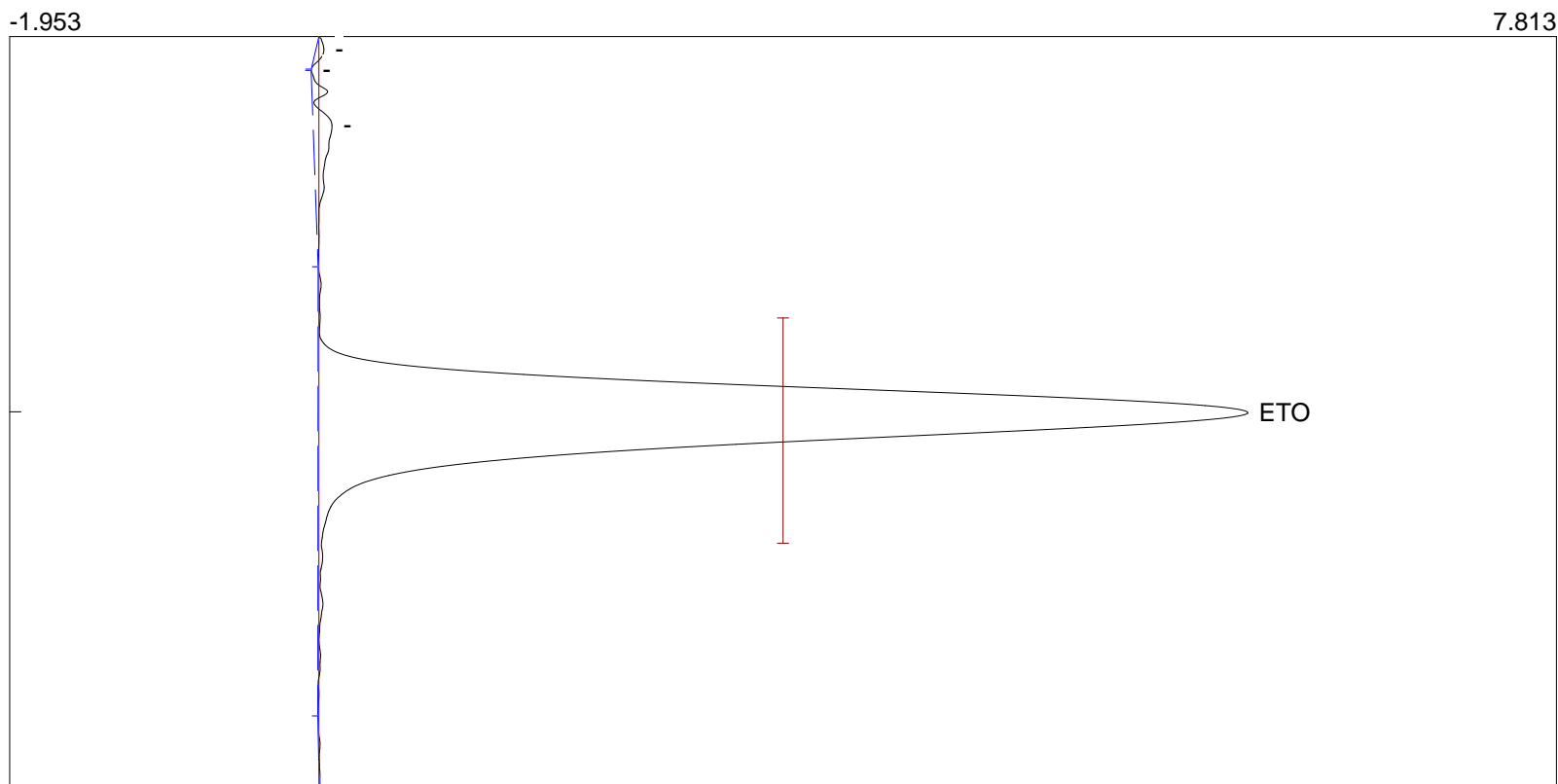
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_16. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 10.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.003	57.3536
1			57.3536

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:27:16

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

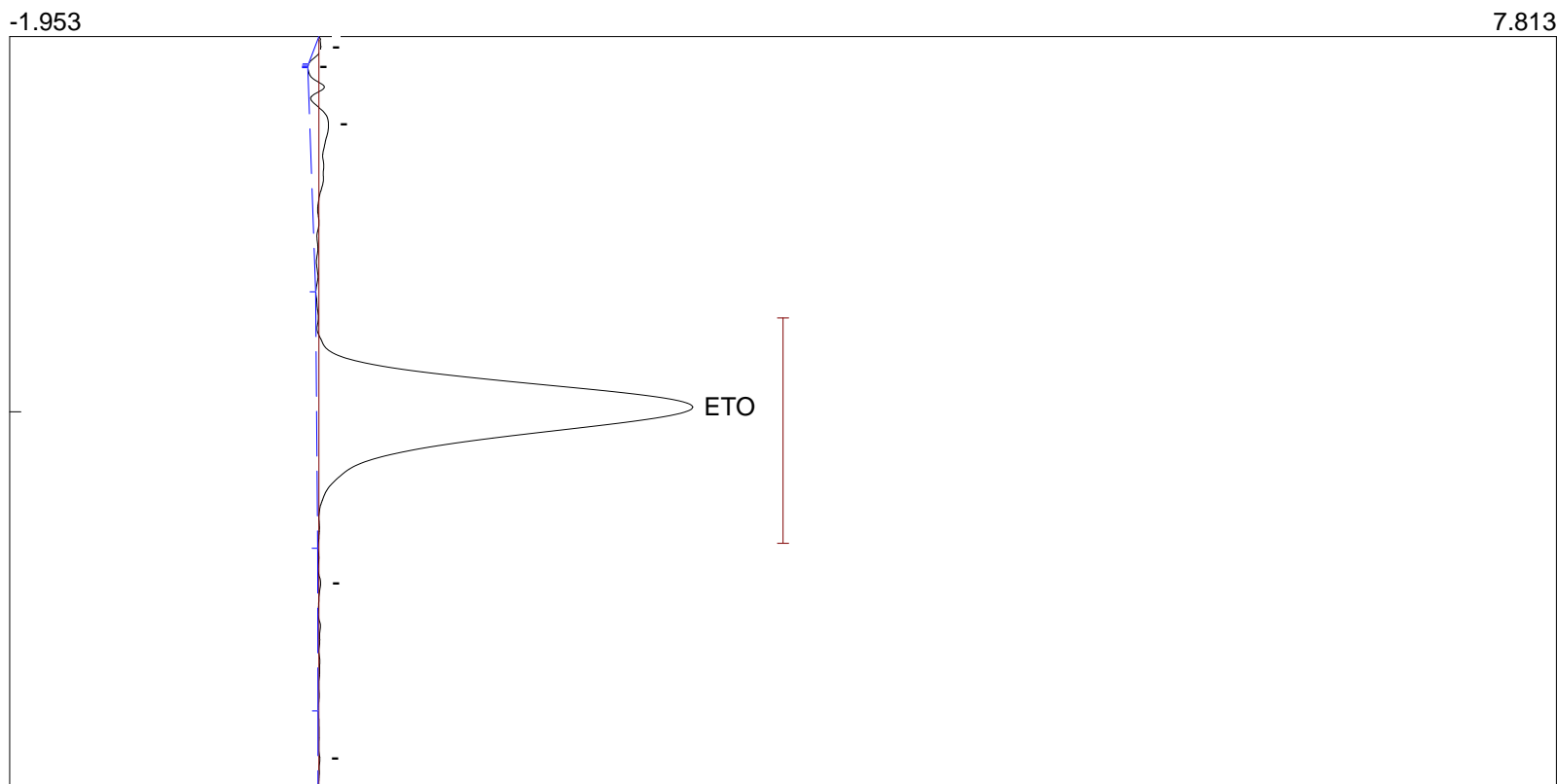
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_23. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.986	23.1481
1			23.1481

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:29:20

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

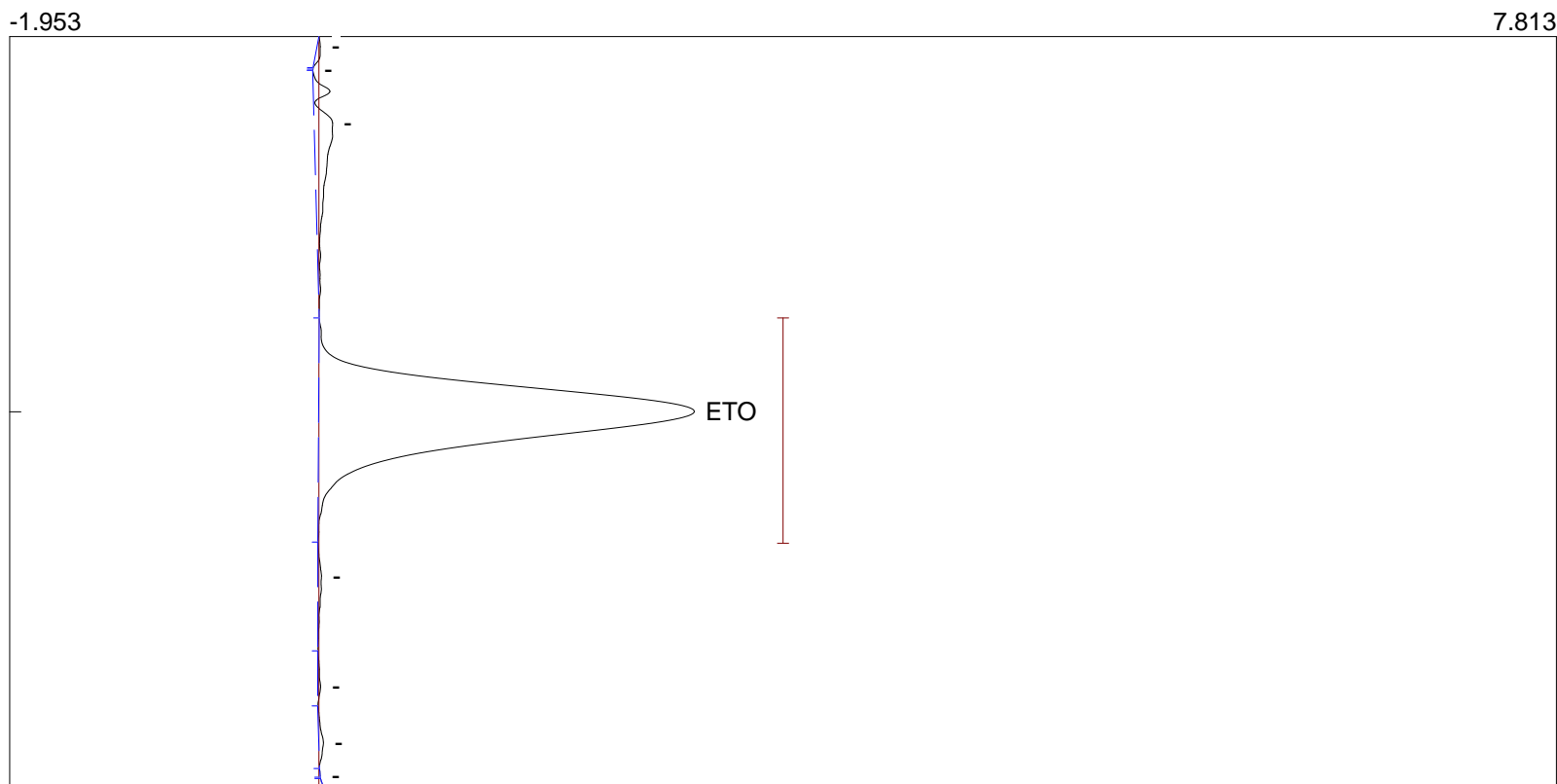
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_24. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.000	22.8419
1			22.8419

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:31:32

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

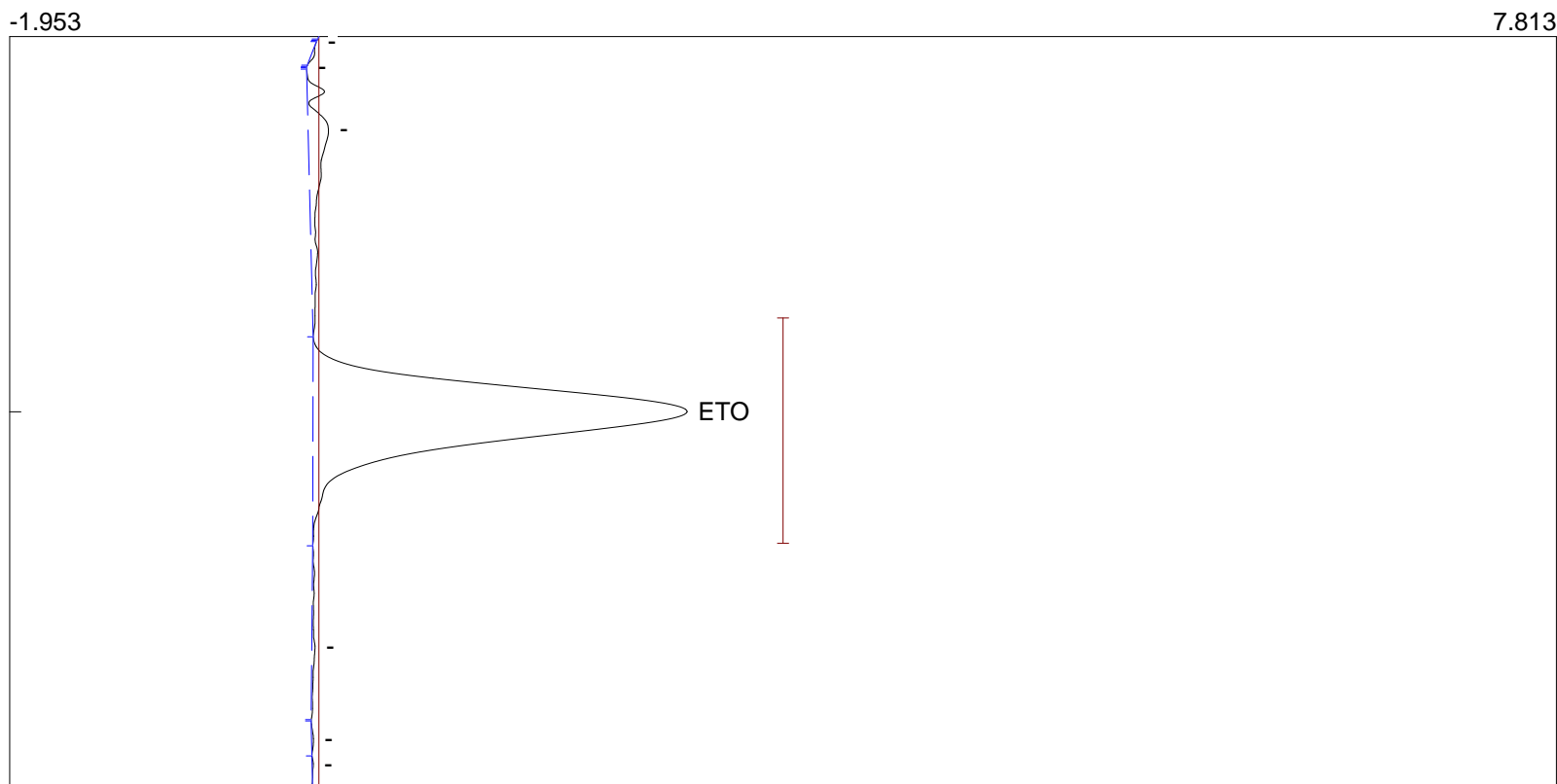
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_25. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.000	22.8187
1			22.8187

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:44:07

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

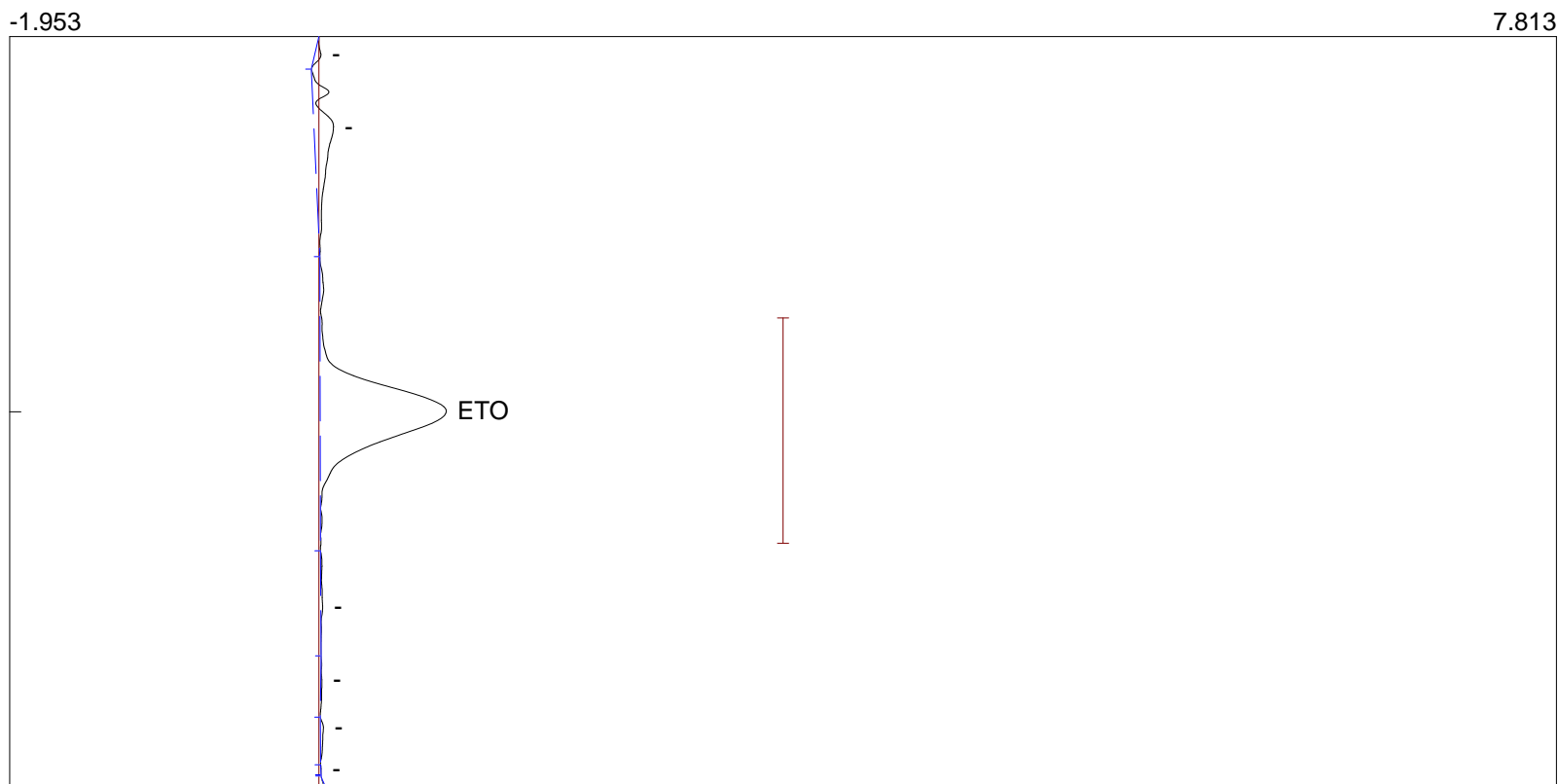
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_31. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 1.05ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.996	7.8420
1			7.8420

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:46:11

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

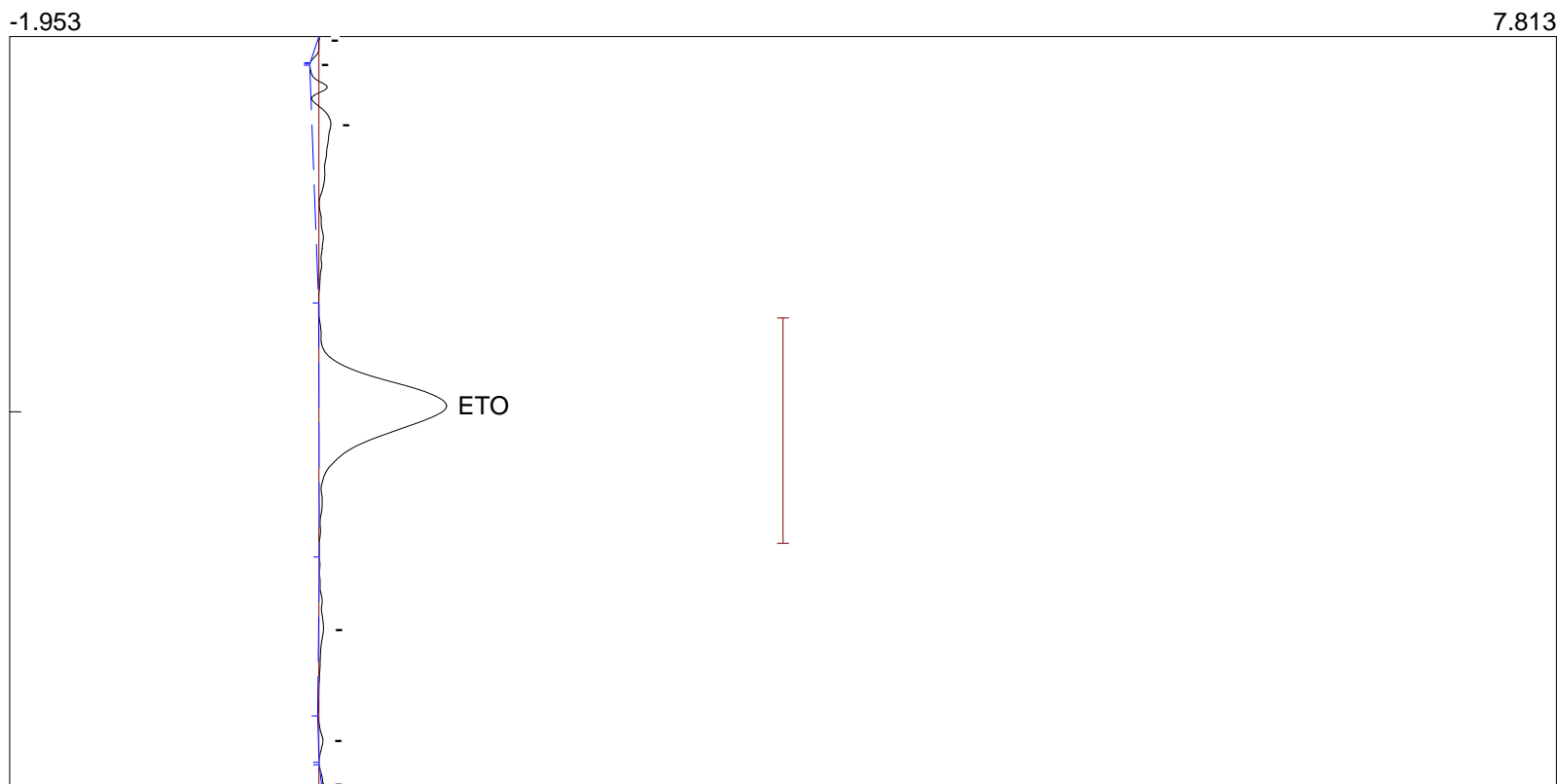
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_32. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 1.05ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	0.983	7.8765
1			7.8765

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 06:48:15

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_33. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 1.05ppm ETO Calibration Gas



Number	Component	Retention	Area
1	ETO	1.000	7.9130
1			7.9130



Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:35:37

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

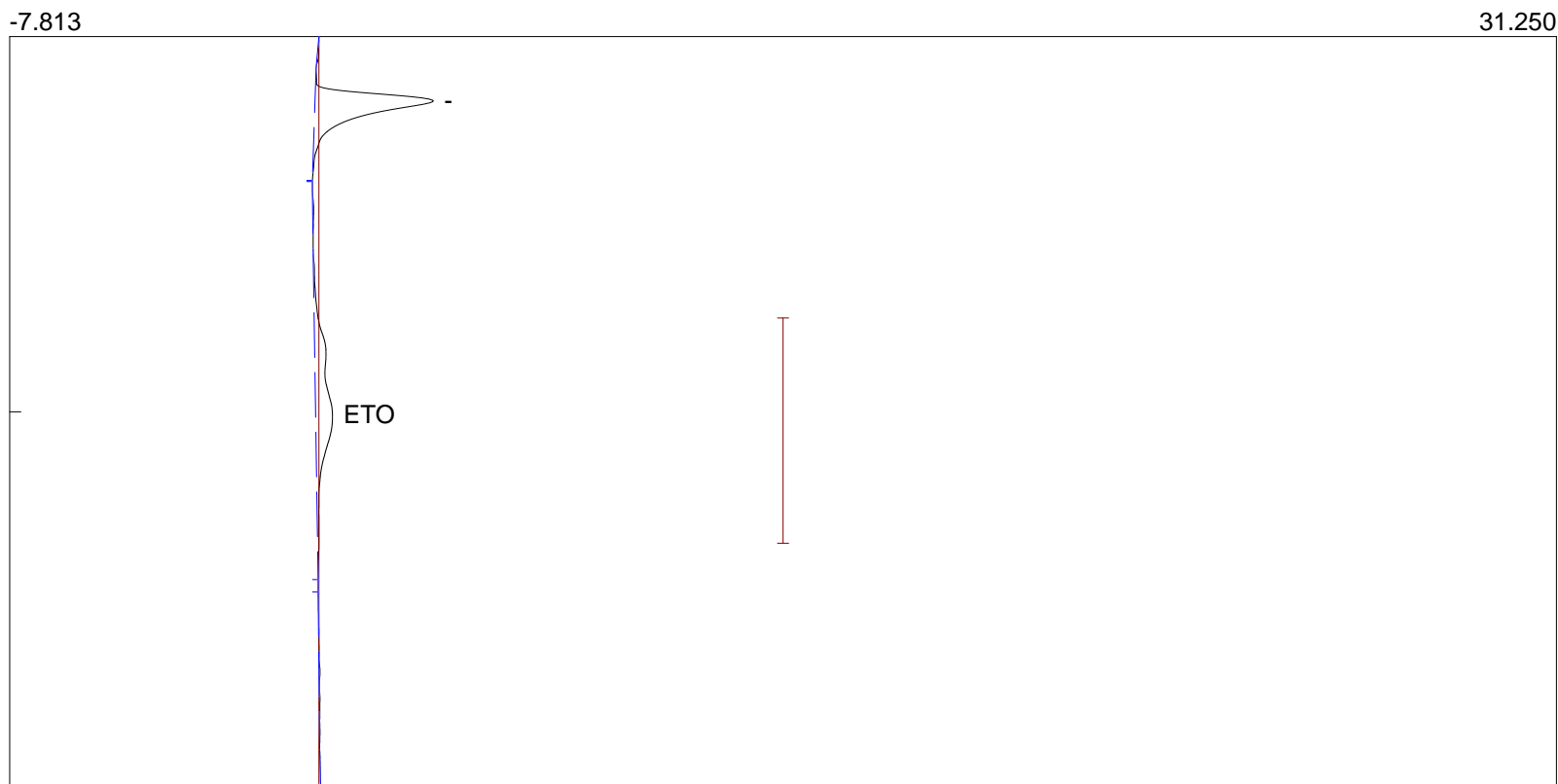
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_41. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1



Number	Component	Retention	Area
1	ETO	1.006	4.0133
1			4.0133

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:37:41

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

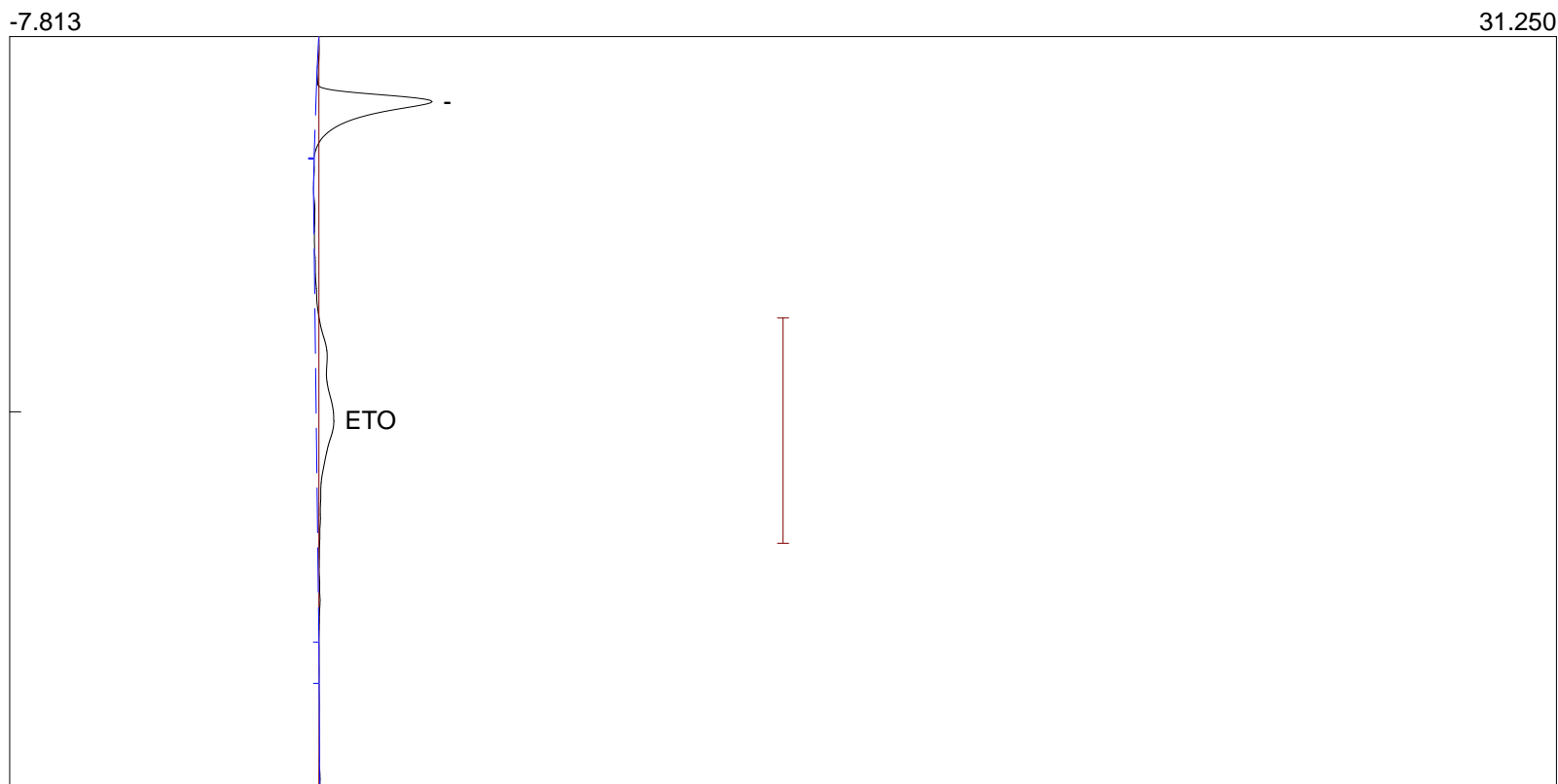
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_42. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1



Number	Component	Retention	Area
1	ETO	1.023	4.1626
1			4.1626

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:41:28

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

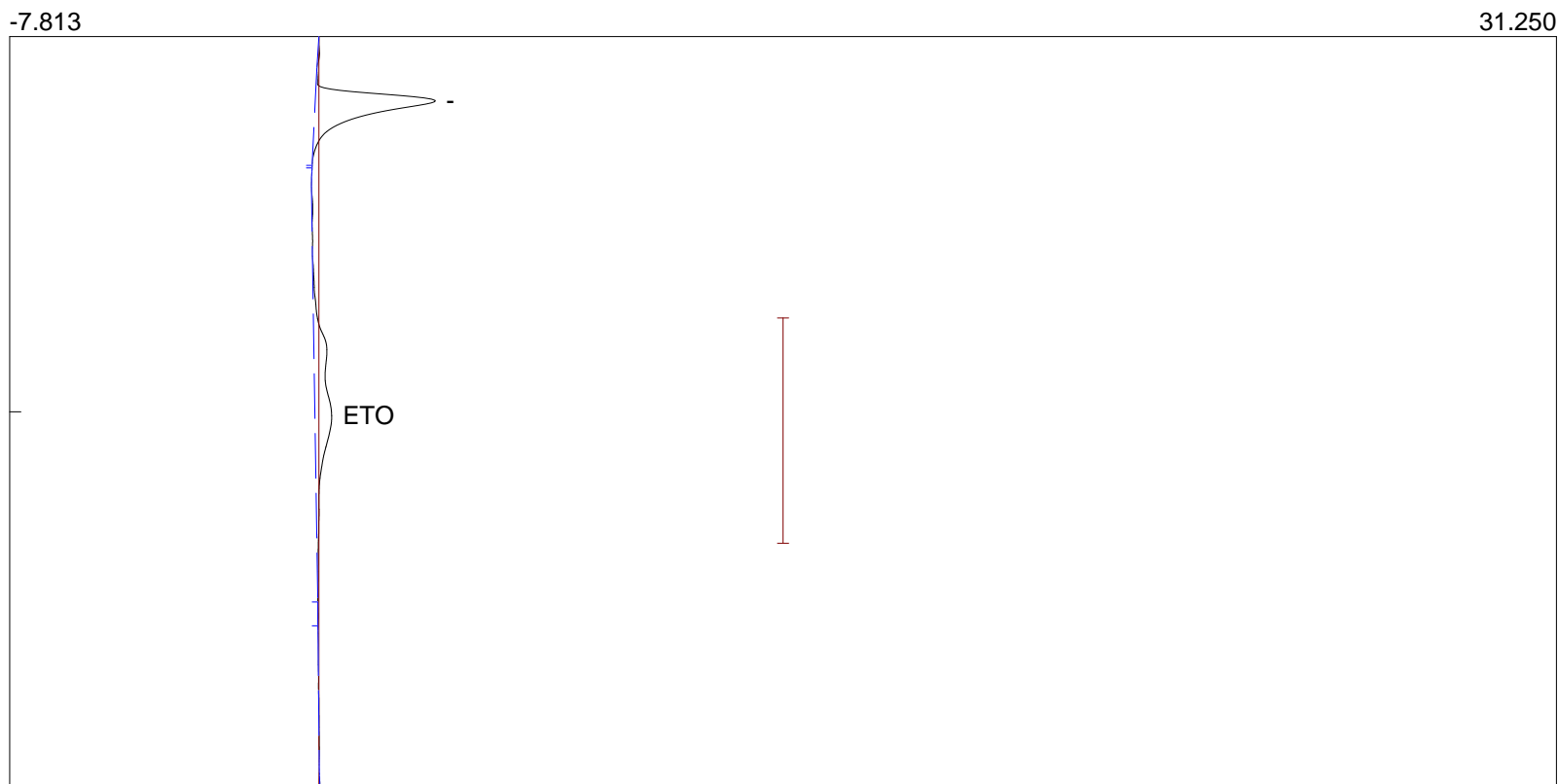
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_43. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1



Number	Component	Retention	Area
1	ETO	1.010	4.1422
1			4.1422

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:47:55

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

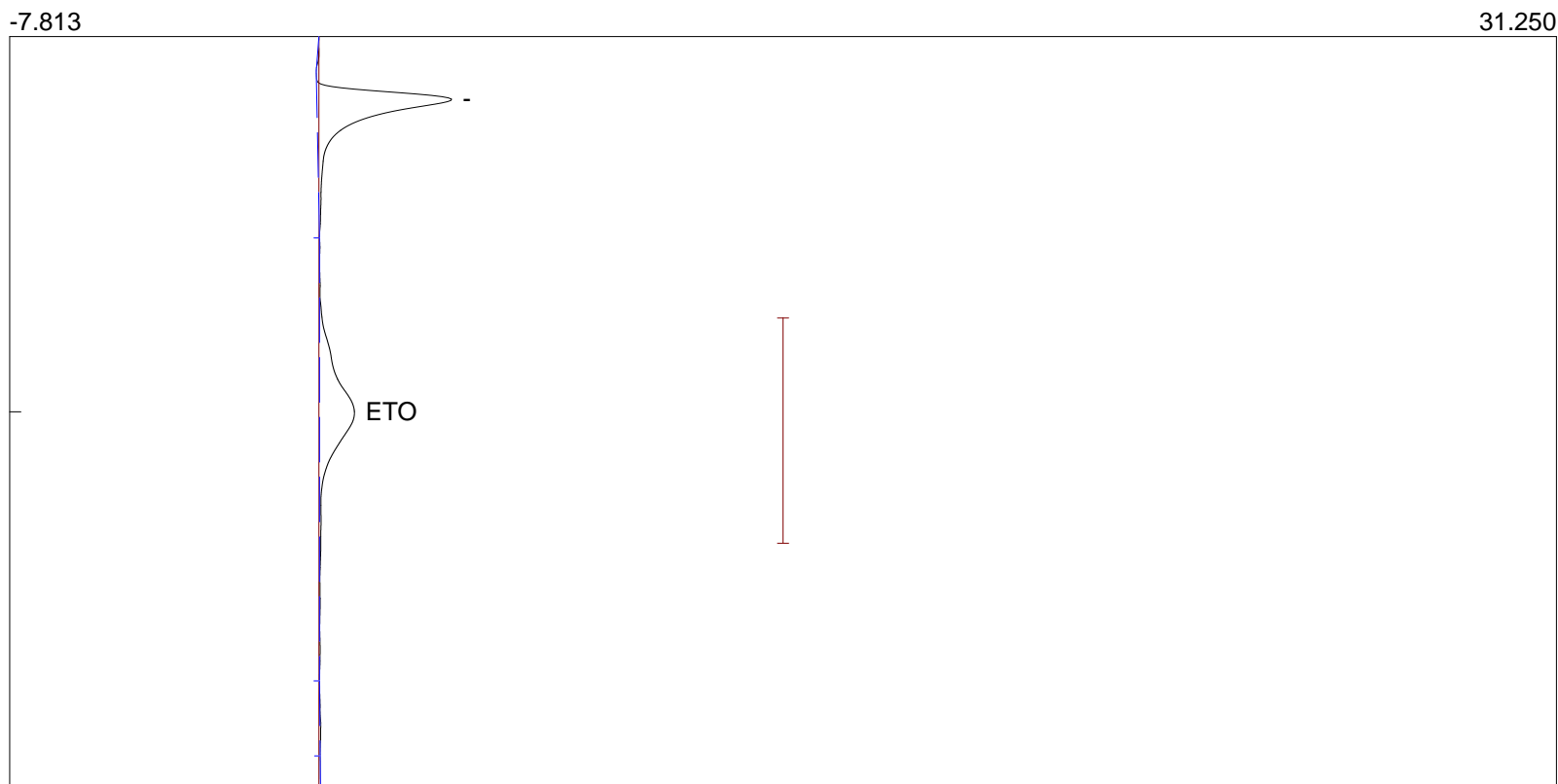
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_46. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1 RS I



Number	Component	Retention	Area
1	ETO	1.000	12.0624
1			12.0624

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:49:59

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

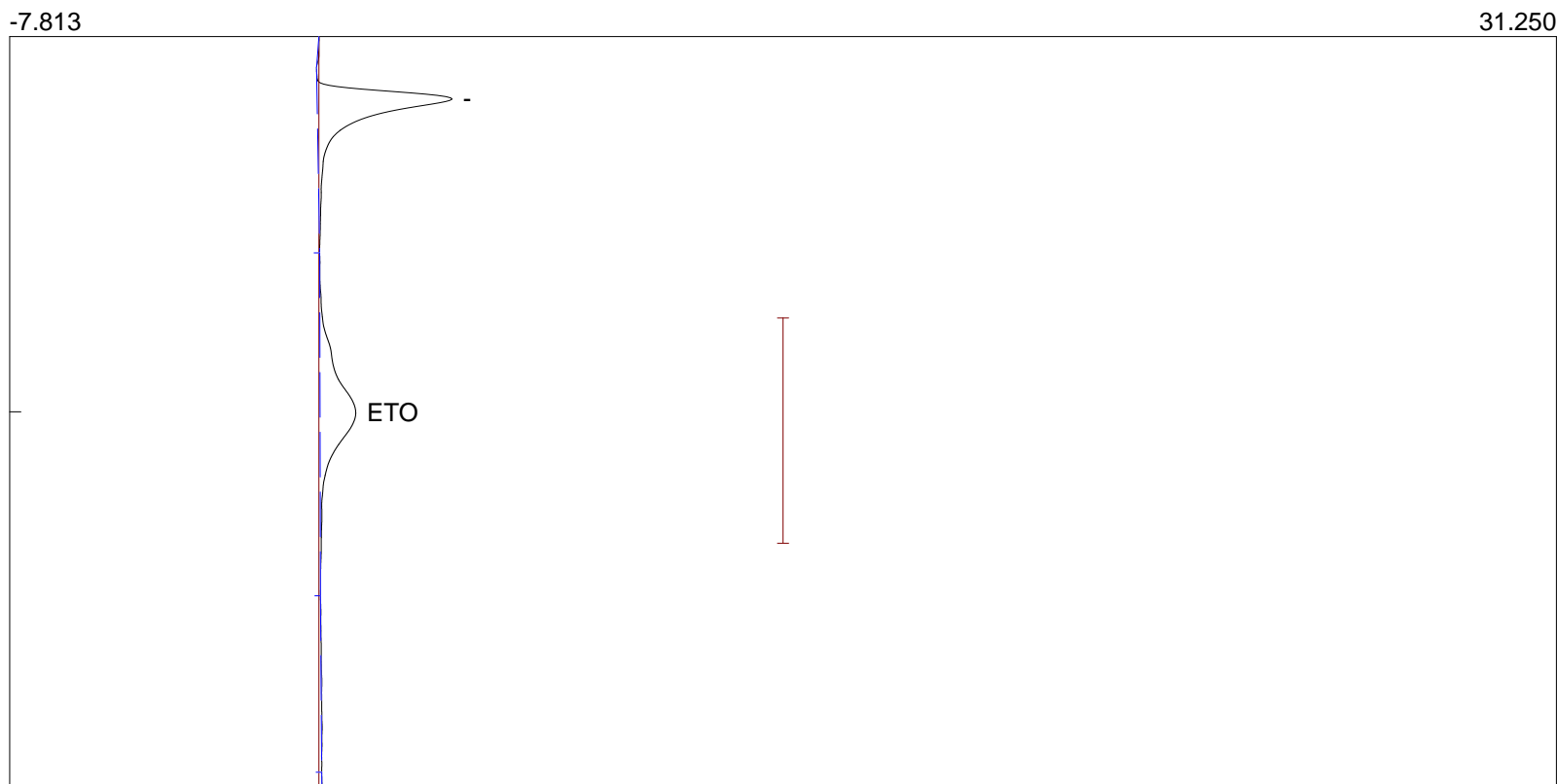
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_47. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1 RS I



Number	Component	Retention	Area
1	ETO	1.003	12.1892
1			12.1892

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:52:02

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

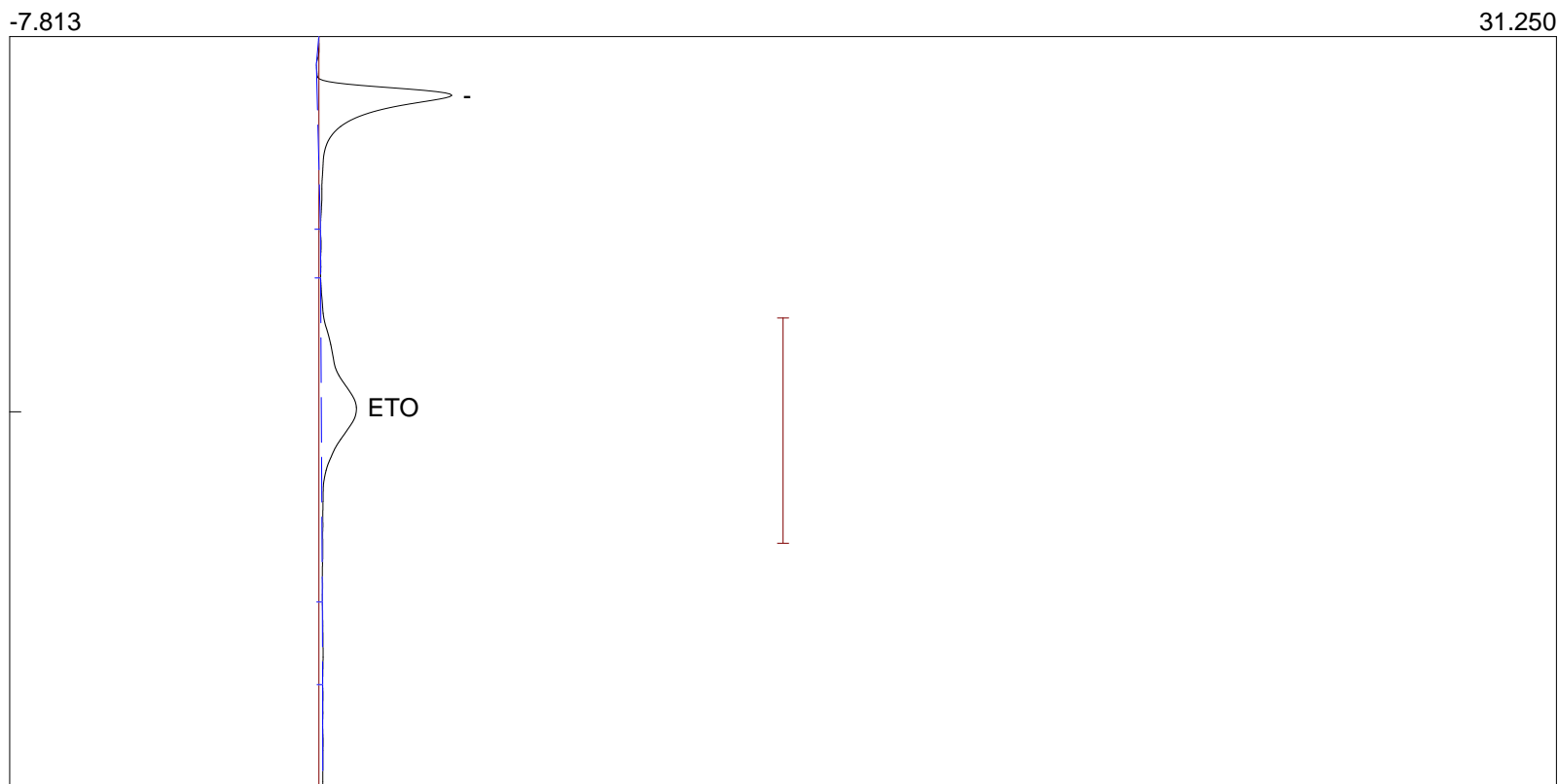
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_48. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R1 RS I



Number	Component	Retention	Area
1	ETO	0.990	11.9158
1			11.9158

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 08:58:31

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

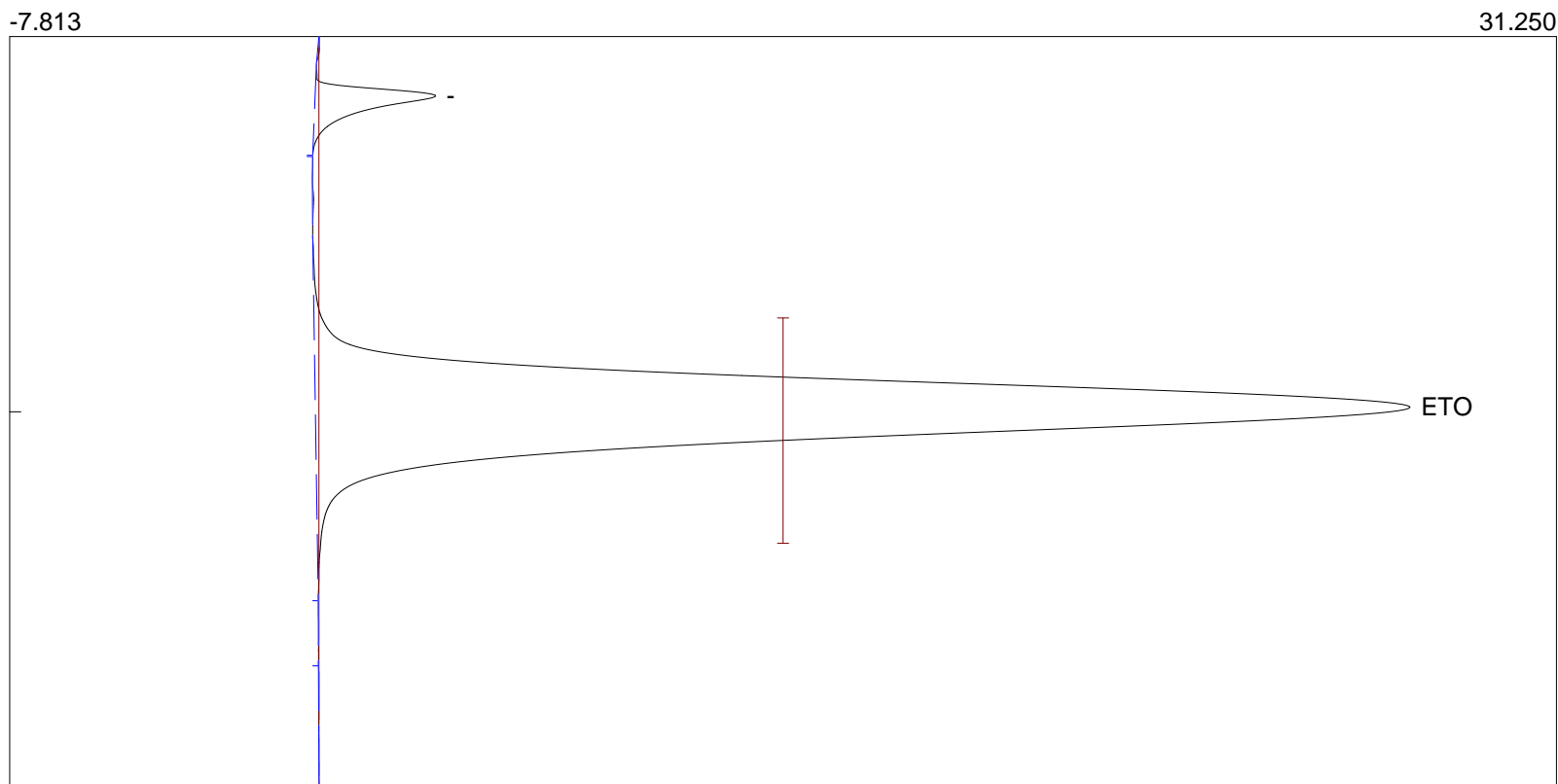
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_51. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inlet R1



Number	Component	Retention	Area
1	ETO	0.986	277.0290
1			277.0290

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:00:36

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

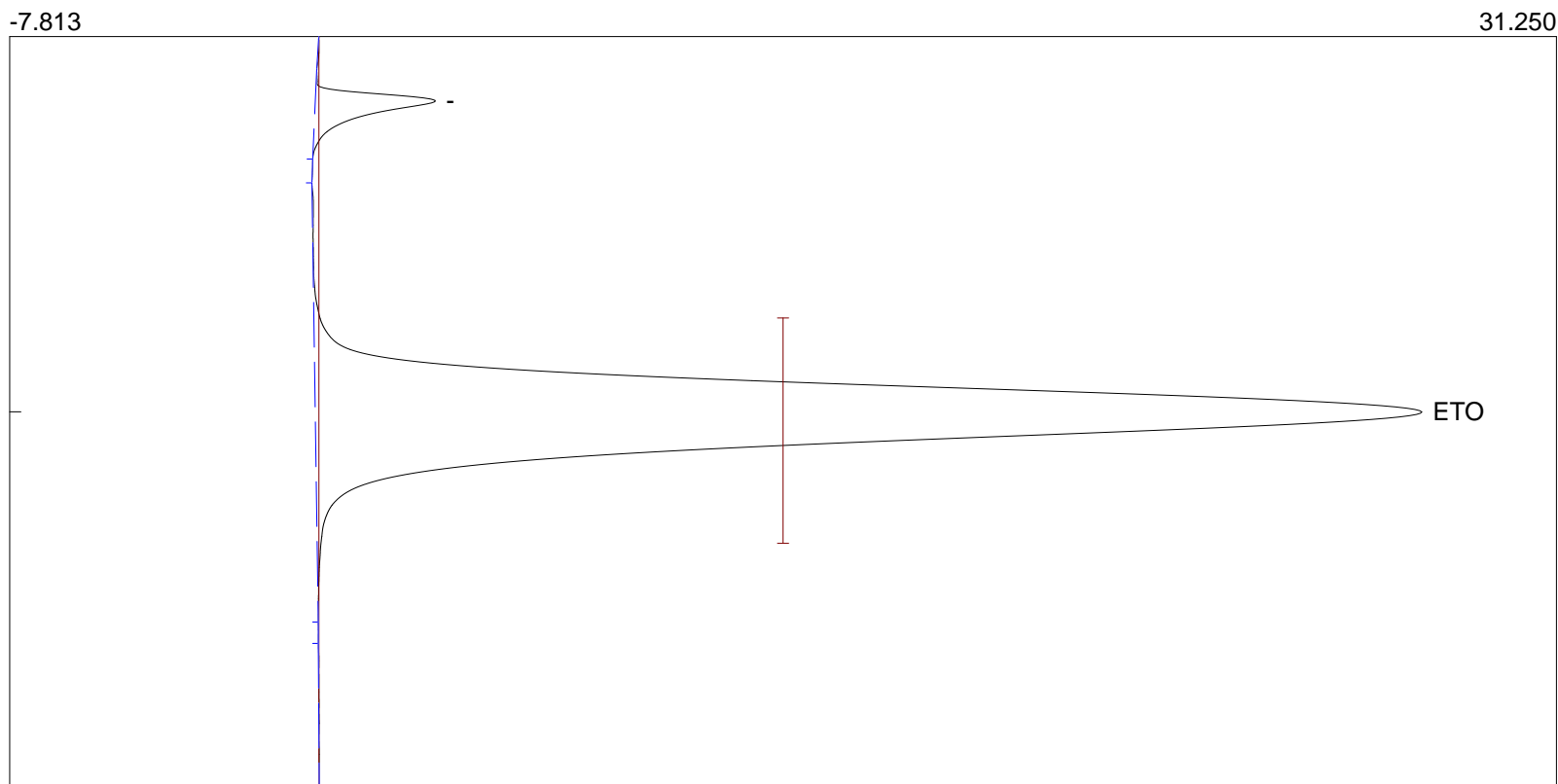
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_52. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inlet R1



Number	Component	Retention	Area
1	ETO	1.000	280.1213
1			280.1213



Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:02:41

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

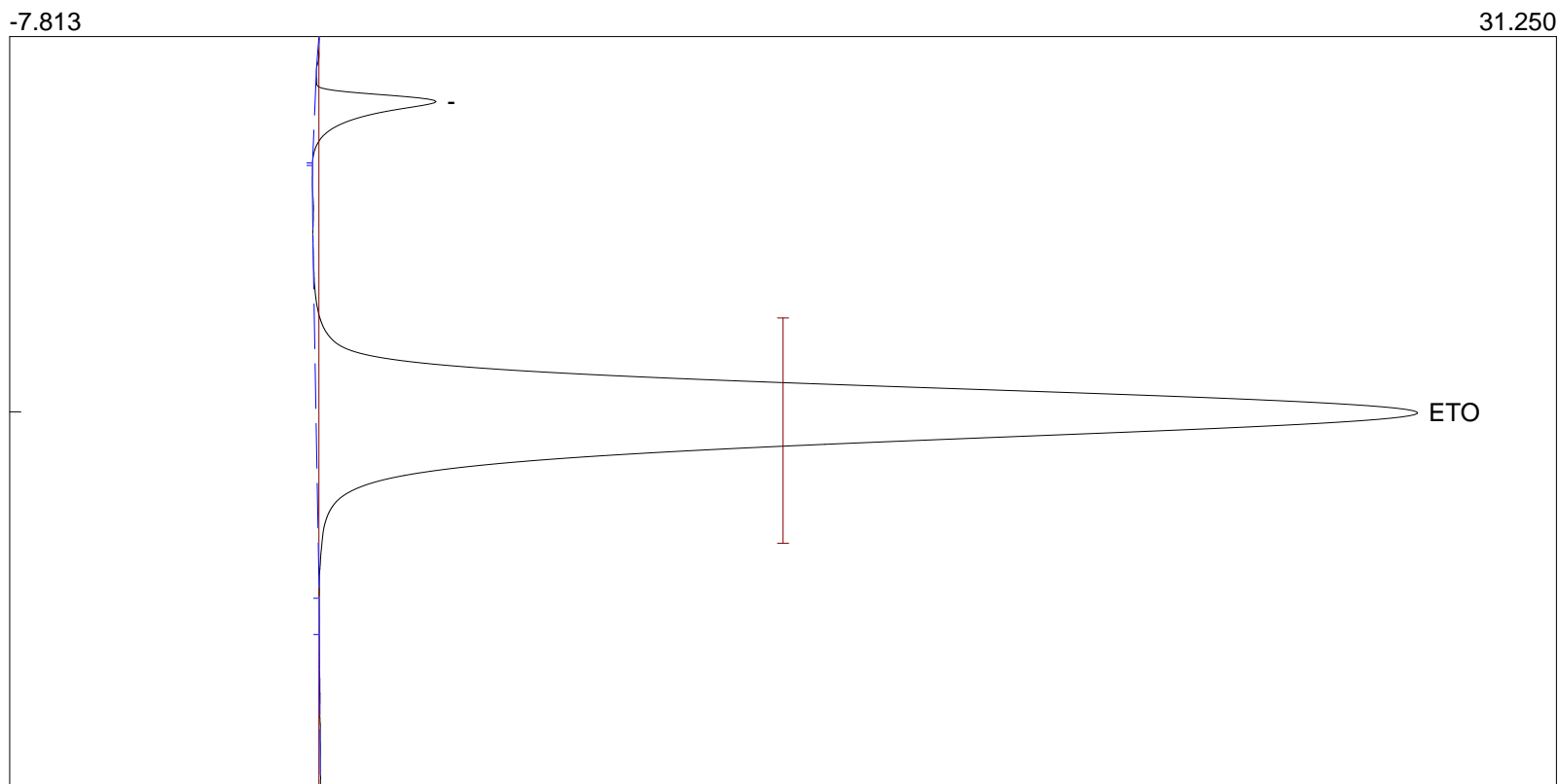
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_53. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inlet R1



Number	Component	Retention	Area
1	ETO	1.003	278.2917
1			278.2917

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:35:57

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

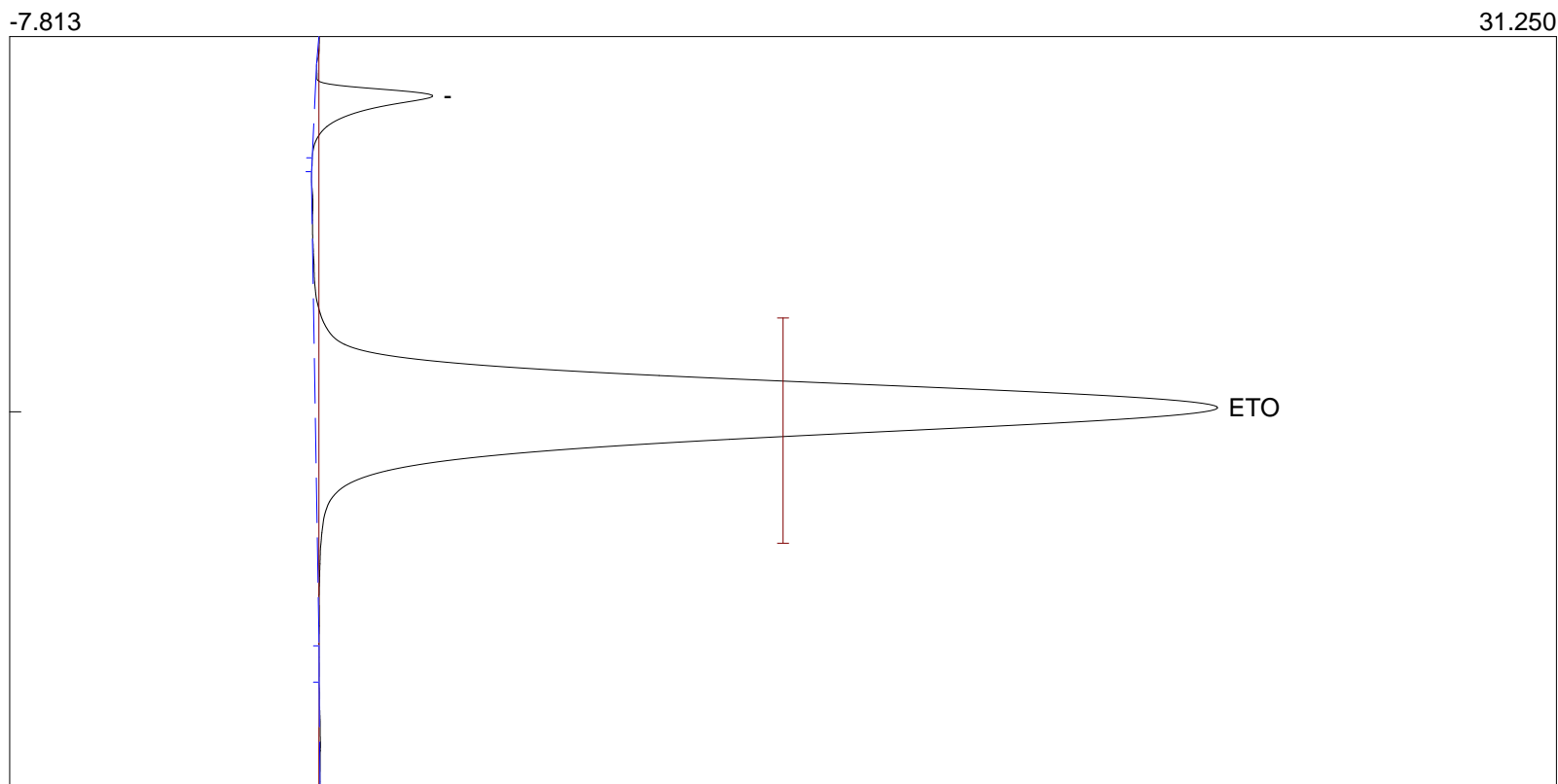
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_58. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inlet R2



Number	Component	Retention	Area
1	ETO	0.990	229.9740
1			229.9740

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:38:01

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

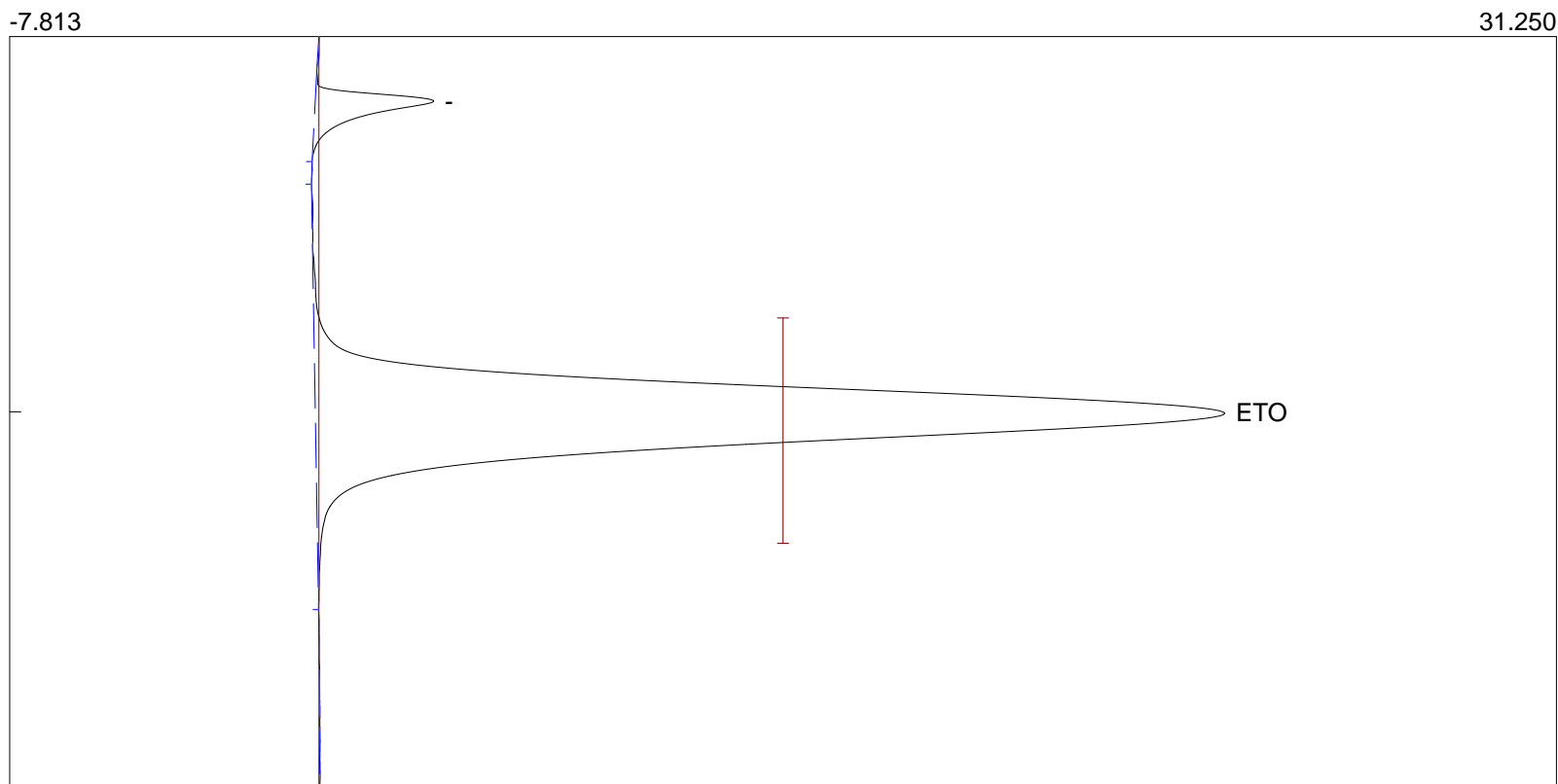
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_59. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inlet R2



Number	Component	Retention	Area
1	ETO	1.003	231.1802
1			231.1802

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:40:06

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

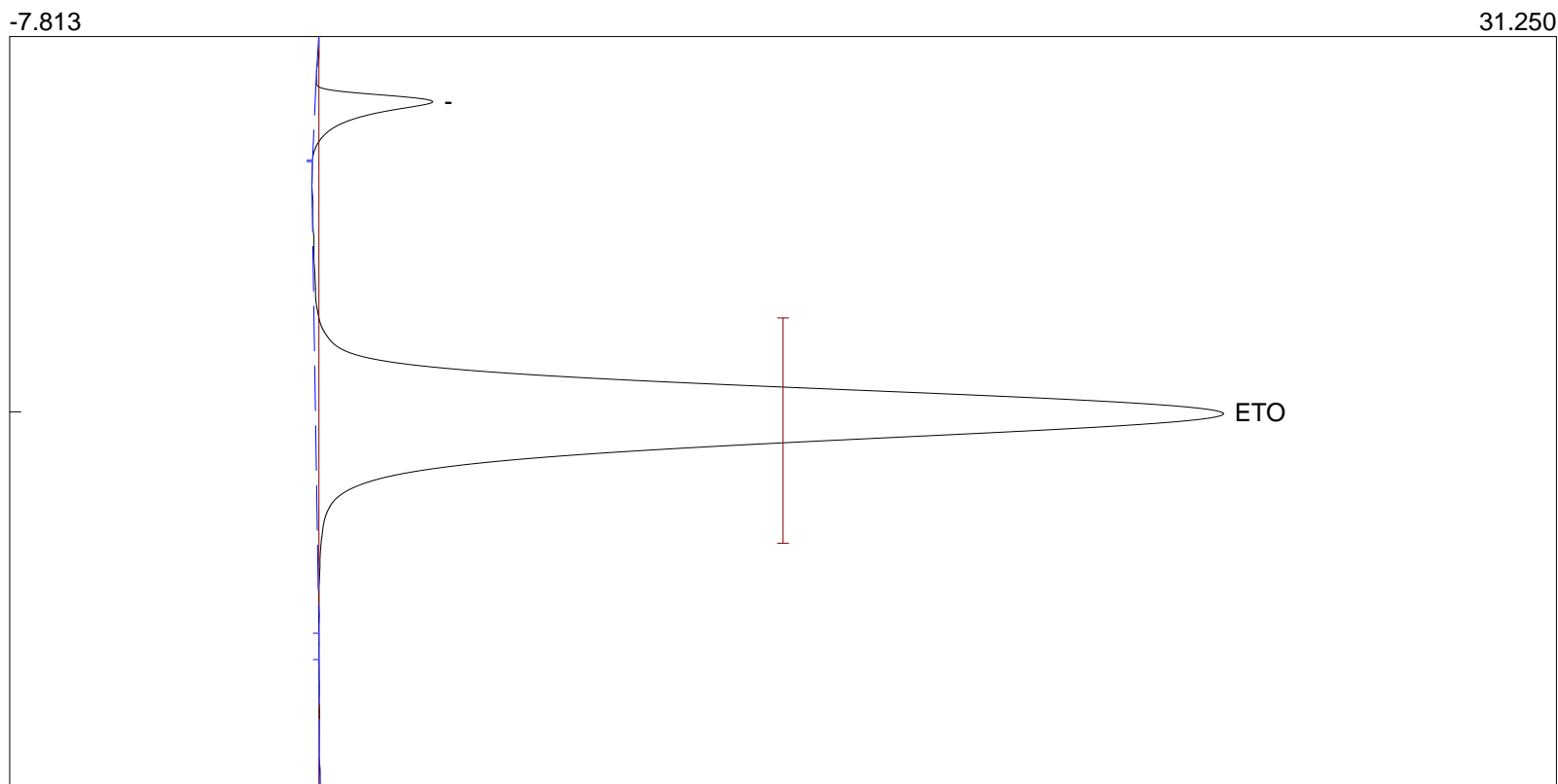
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_60. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R2



Number	Component	Retention	Area
1	ETO	1.003	230.8090
1			230.8090

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:48:29

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_64. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R2



Number	Component	Retention	Area
1	ETO	1.006	4.8308
1			4.8308

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:50:37

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_65. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R2

-7.813

31.250

1

Number	Component	Retention	Area
0			0.0000

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 09:52:47

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_66. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Outlet R2

-7.813

31.250

1

Number	Component	Retention	Area
0			0.0000

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:25:22

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_71. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inler R1 RS Aged



Number	Component	Retention	Area
1	ETO	1.003	12.3576
1			12.3576



Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:27:26

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_72. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inler R1 RS Aged



Number	Component	Retention	Area
1	ETO	0.993	12.2380
1			12.2380

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:29:30

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_73. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: Inler R1 RS Aged



Number	Component	Retention	Area
1	ETO	1.006	12.0147
1			12.0147

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:33:44

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

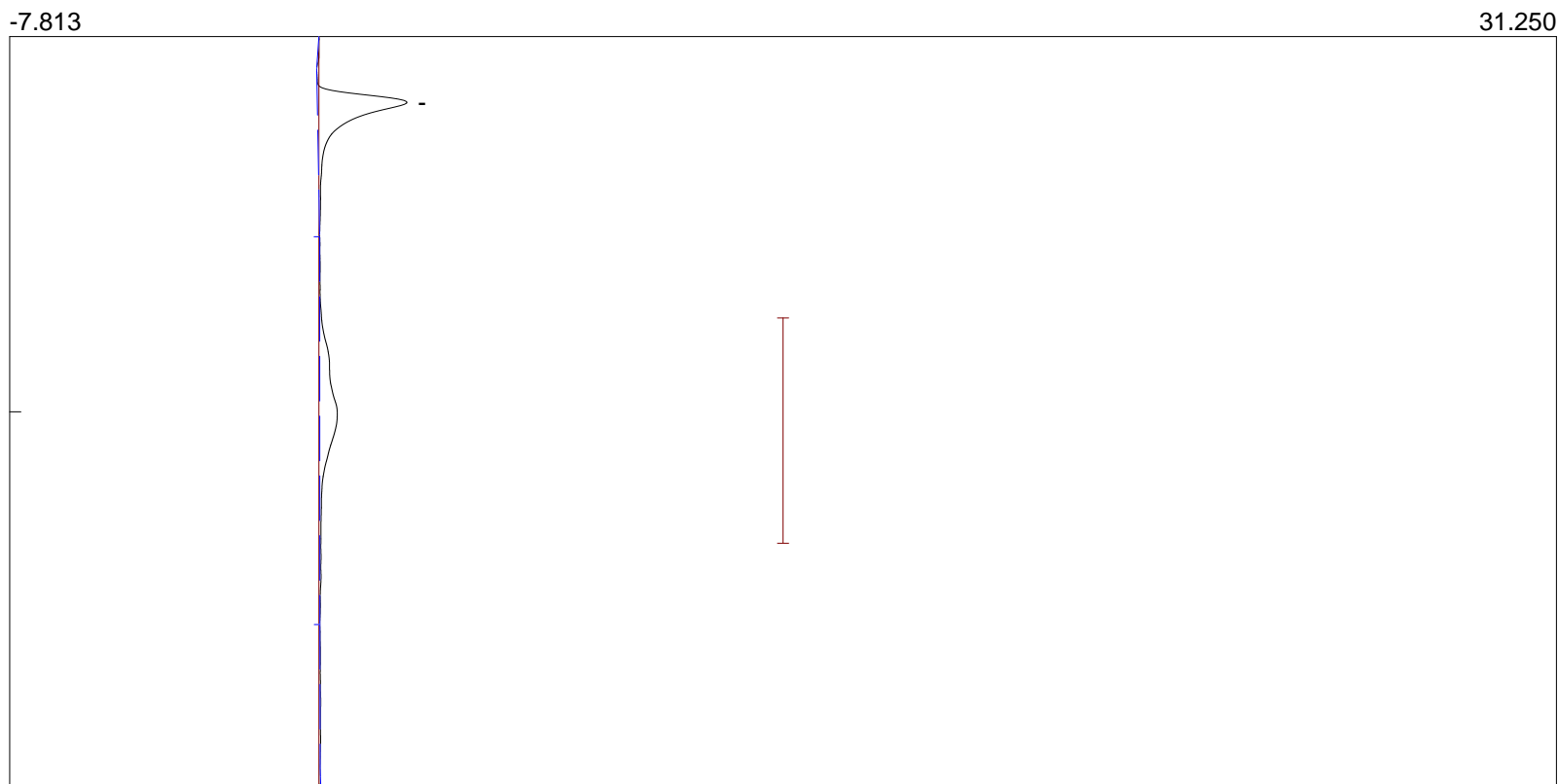
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_75. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: AAT Outlet R3



Number	Component	Retention	Area
0			0.0000

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:35:48

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_76. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: AAT Outlet R3

-7.813

31.250

1

Number	Component	Retention	Area
0			0.0000

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:46:35

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

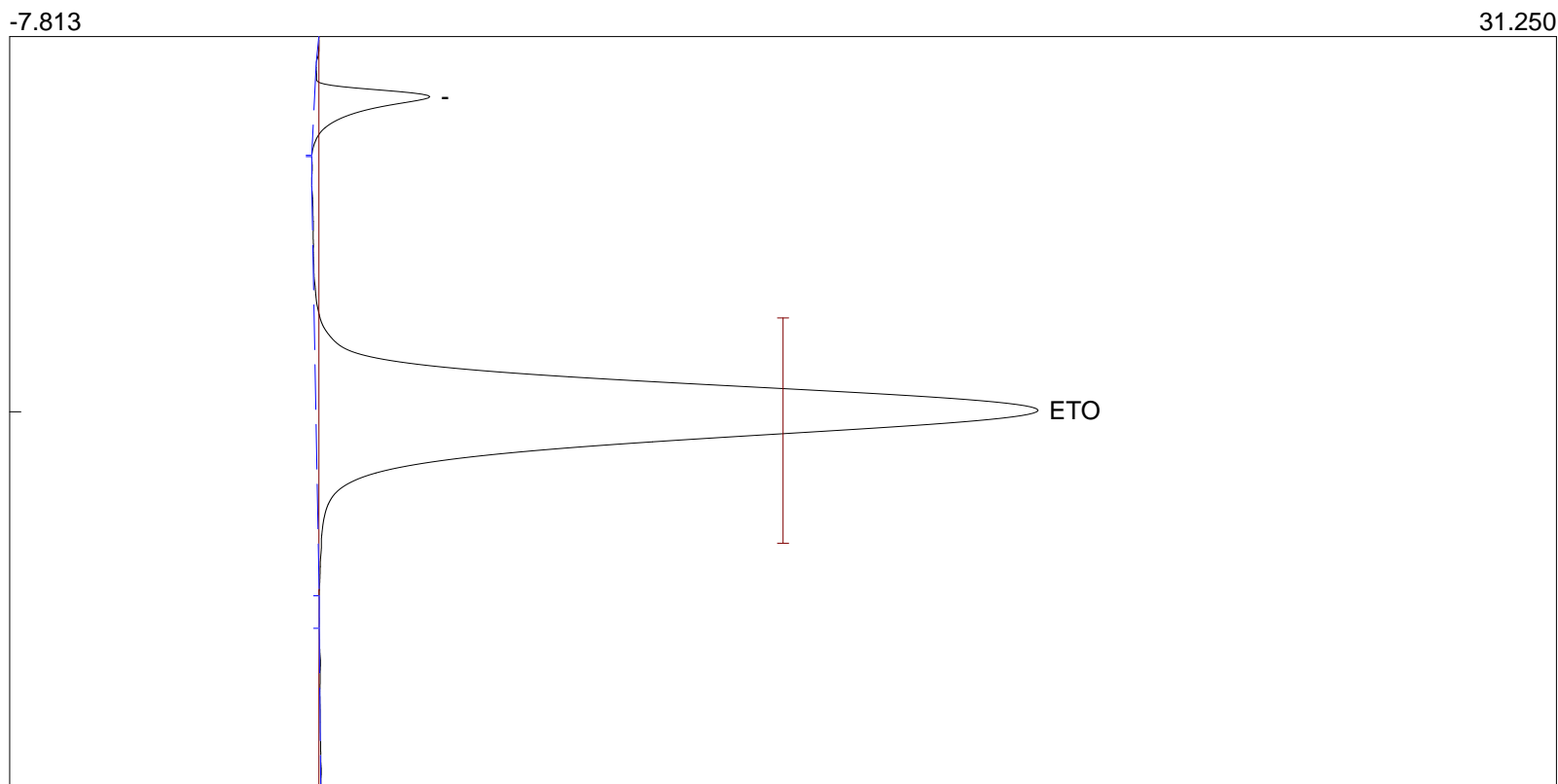
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_81. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: AAT Inlet R3



Number	Component	Retention	Area
1	ETO	0.996	185.0000
1			185.0000

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:48:41

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

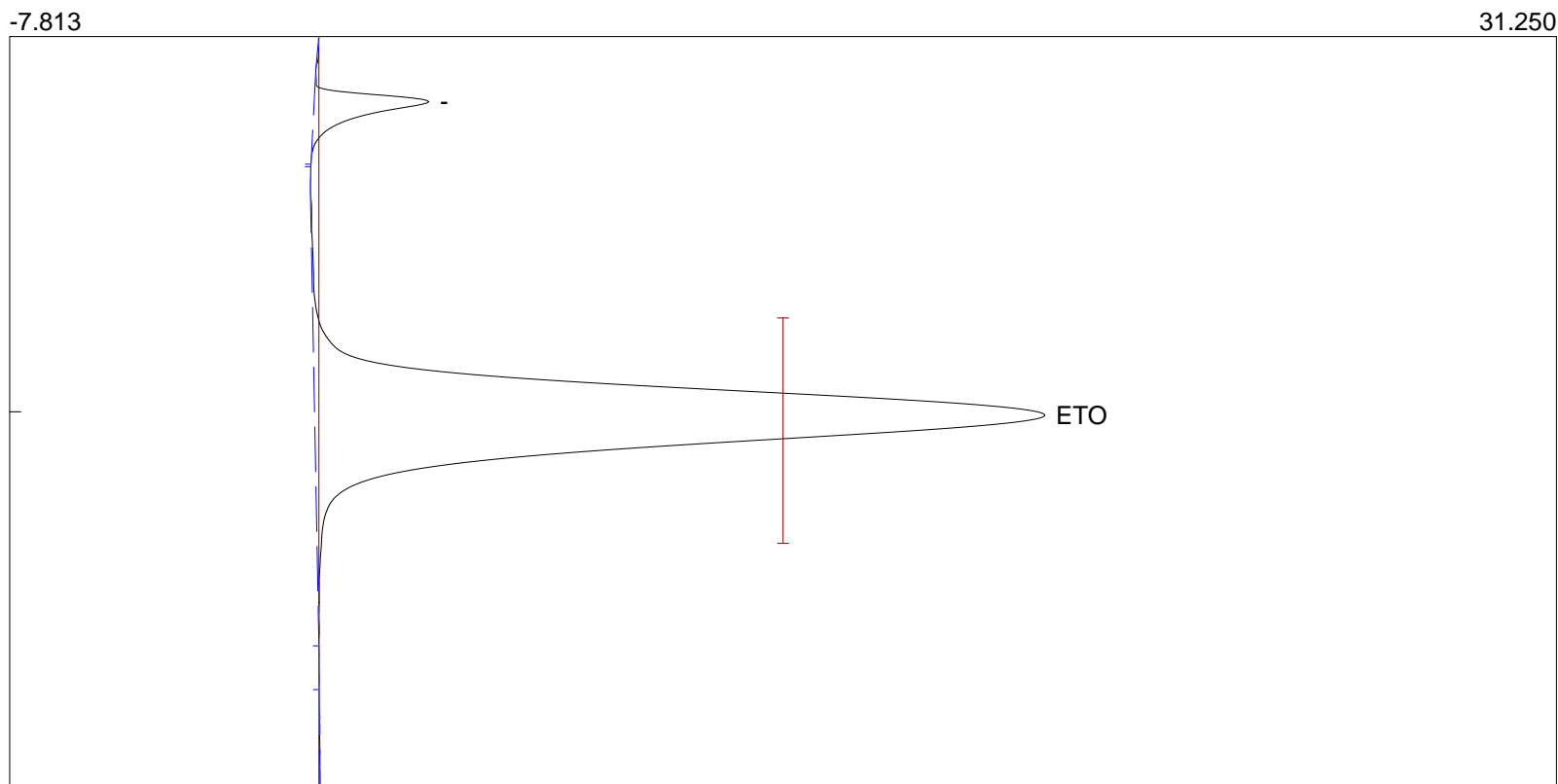
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_82. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: AAT Inlet R3



Number	Component	Retention	Area
1	ETO	1.010	187.7634
1			187.7634

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 10:50:46

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

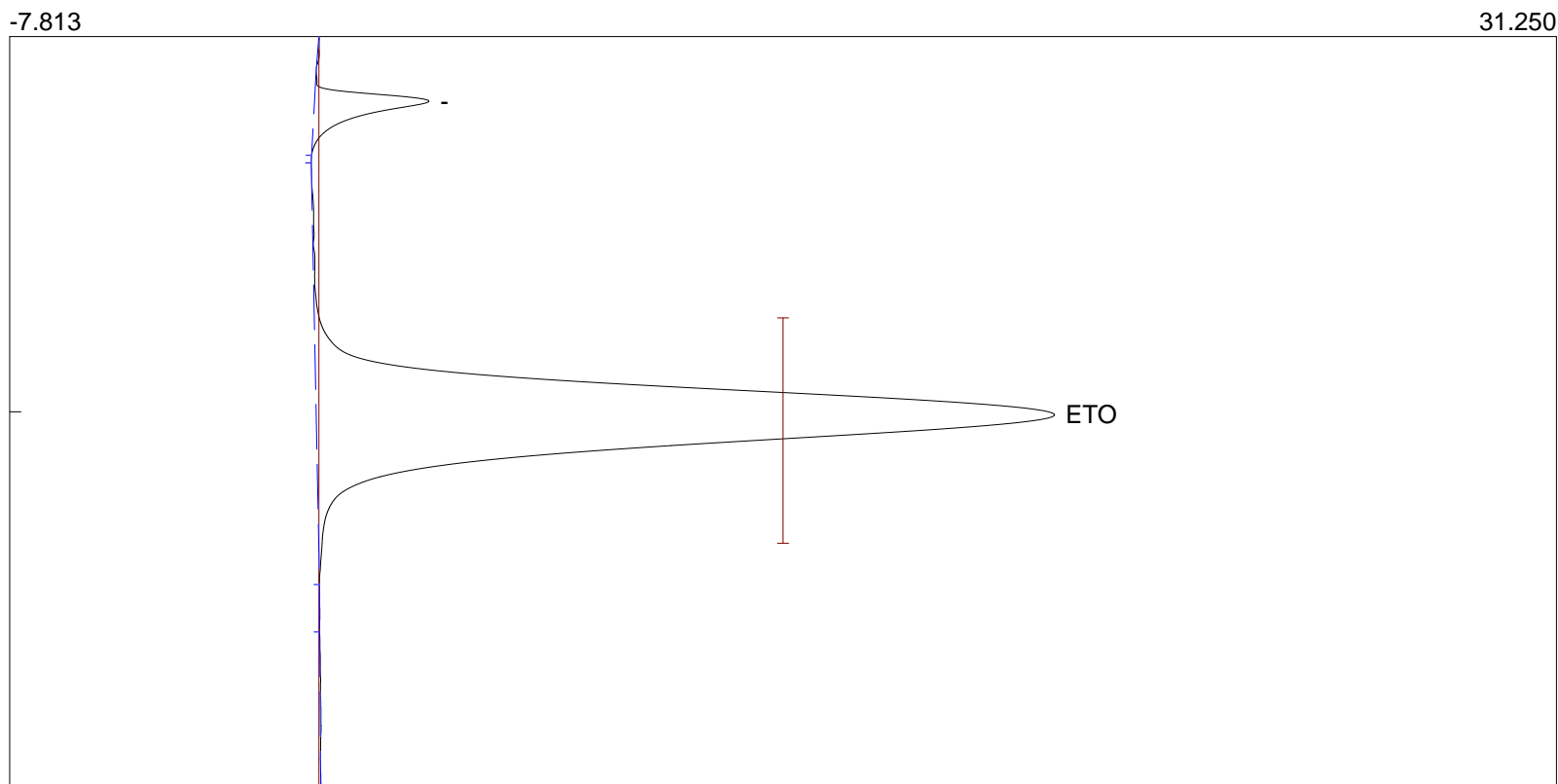
Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_83. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: AAT Inlet R3



Number	Component	Retention	Area
1	ETO	1.006	189.1198
1			189.1198

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 11:02:53

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_88. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas Drift Test



Number	Component	Retention	Area
1	ETO	1.000	22.3844
1			22.3844



Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 11:05:01

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_89. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas Drift Test



Number	Component	Retention	Area
1	ETO	0.876	22.3674
1			22.3674

Lab name: LCH Consulting Associates, LLC

Client: Long Island Sterilization

Client ID: LIS

Analysis date: 09/17/2020 11:07:15

Method: USEPA Method 18

Lab ID: PADEP 15-05860

Description: FID

Column: Haysep D

Carrier: UHP 99.99999% Helium AT 18 PSI

Data file: 091720LIS\_90. ()

Sample: ARV AAT

Operator: L Christopher Heilner

Comments: 5.1ppm ETO Calibration Gas Drift Test



Number	Component	Retention	Area
1	ETO	0.843	21.6693
1			21.6693

**ATTACHMENT D**  
**SPREADSHEETS**

# Flow and Moisture Determinations

Date	17-Sep
Facility	Long Island Sterilization
Test ID	SCV Outlet Run 1
P <sub>bar</sub> ("Hg)	29.9
Pstatic ("H <sub>2</sub> O)	-0.25
Diameter (")	14
Oxygen %	20.9
Carbon Dioxide %	0.4

Method 2 Flow Determinations				
Clock Time	Traverse Point	ΔP ("H <sub>2</sub> O)	Stack Temperature (°F)	Square Root of ΔP ("H <sub>2</sub> O)
815	1	0.075	110	0.2738613
	2	0.075	110	0.2738613
	3	0.075	110	0.2738613
	4	0.095	110	0.3082207
	5	0.1	110	0.3162278
	6	0.12	110	0.3464102
	1	0.12	112	0.3464102
	2	0.1	112	0.3162278
	3	0.115	112	0.3391165
	4	0.11	112	0.3316625
	5	0.12	111	0.3464102
915	6	0.125	111	0.3535534

*averages*      **0.103**      **110.833**      **0.319**

V <sub>w(std)</sub>	<b>2.00</b>	grams
VM <sub>(std)</sub>	<b>20.54</b>	DSCF
B <sub>wo</sub>	<b>0.09</b>	
B <sub>ws</sub>	<b>8.89</b>	%
M <sub>d</sub>	<b>28.90</b>	lb/lb-mole
M <sub>s</sub>	<b>27.93</b>	lb/lb-mole
P <sub>s</sub>	<b>29.88</b>	"Hg
V <sub>s</sub>	<b>18.93</b>	FPS
A <sub>s</sub>	<b>1.07</b>	sqft
Q <sub>s</sub>	<b>1213.85</b>	ACFM
Q <sub>s(std)</sub>	<b>1021.21</b>	DSCFM
Cs(inlet)	<b>54.02</b>	PPMvd
E(inlet)	<b>0.44</b>	lbs/hr
Cs(outlet)	<b>0.84</b>	PPMvd
E(Outlet)	<b>0.01</b>	lbs/hr

Date	17-Sep
Facility	Long Island Sterilization
Unit	SCV Outlet Run 1
Meter Box ID	1
Meter γ	1.007
Meter ΔH@	1.81
Pitot ID	P4
Pitot C <sub>p</sub>	0.84

Method 4 Moisture Determinations						
Clock Time	Elapsed Time	Dry Gas Meter Displacement (DSCF)	ΔH ("H <sub>2</sub> O)	Meter Temperature (°F)	Vacuum ("Hg)	Impinger Exit Temperature (°F)
	0	0				
	5					
	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45					
	50					
	55					

Impinger 2	0	0	<b>0</b>
Impinger 3	0	0	<b>0</b>
Impinger 4	0	0	<b>42.6</b>

V<sub>wc</sub>      **42.6**

Inlet	Outlet	
54.016419	0.7538804	ppm <sub>vw</sub>
60.0	0.8	ppm <sub>vd</sub>
44.05		Molecular Weight
0.4420164	0.006169	lbs/hr
8.888313797		Bws by Saturation

Flow and Moisture Determinations

Date	17-Sep
Facility	Long Island Sterilization
Test ID	SCV Outlet Run 2
P <sub>bar</sub> ("Hg)	29.9
Pstatic ("H <sub>2</sub> O)	-0.25
Diameter (")	14
Oxygen %	20.9
Carbon Dioxide %	0.4

Method 2 Flow Determinations				
Clock Time	Traverse Point	ΔP ("H <sub>2</sub> O)	Stack Temperature (°F)	Square Root of ΔP ("H <sub>2</sub> O)
920	1	0.09	115	0.3
	2	0.012	115	0.1095445
	3	0.135	115	0.3674235
	4	0.135	115	0.3674235
	5	0.13	115	0.3605551
	6	0.135	115	0.3674235
	1	0.125	115	0.3535534
	2	0.125	115	0.3535534
	3	0.135	115	0.3674235
	4	0.14	115	0.3741657
	5	0.15	115	0.3872983
1020	6	0.15	115	0.3872983
1608				

*averages      0.122      115.000      0.341*

V <sub>w(std)</sub>	2.28	grams
VM <sub>s(std)</sub>	20.54	DSCF
B <sub>wo</sub>	0.10	
B <sub>ws</sub>	10.01	%
M <sub>d</sub>	28.90	lb/lb-mole
M <sub>s</sub>	27.81	lb/lb-mole
P <sub>s</sub>	29.88	"Hg
V <sub>s</sub>	20.39	FPS
A <sub>s</sub>	1.07	sqft
Q <sub>s</sub>	1307.05	ACFM
Q <sub>s(std)</sub>	1078.26	DSCFM
Cs(inlet)	44.80	PPMvd
E(inlet)	0.37	lbs/hr
Cs(outlet)	0.29	PPMvd
E(Outlet)	0.00	lbs/hr

Date	17-Sep
Facility	Long Island Sterilization
Unit	SCV Outlet Run 2
Meter Box ID	1
Meter γ	1.007
Meter ΔH@	1.81
Pitot ID	P4
Pitot C <sub>p</sub>	0.84

Method 4 Moisture Determinations						
Clock Time	Elapsed Time	Dry Gas Meter Displacement (DSCF)	ΔH ("H <sub>2</sub> O)	Meter Temperature (°F)	Vacuum ("Hg)	Impinger Exit Temperature (°F)
	0	0				
	5					
	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45					
	50					
	55					
	60	21	1.5	85		

*averages      21.00      1.50      85.00      #DIV/0!      #DIV/0!*

	Initial	Final	Difference
Impinger 1	0	0	0
Impinger 2	0	0	0
Impinger 3	0	0	0
Impinger 4	0	0	48.55

*V<sub>wc</sub>      48.55*

Inlet	Outlet	
44.8000269	0.7538804	ppm <sub>vw</sub>
49.8	0.3	ppm <sub>vd</sub>
44.05		Molecular Weight
0.3665987	0.0021581	lbs/hr
10.01008007		Bws by Saturation

# Flow and Moisture Determinations

Date	17-Sep
Facility	Long Island Sterilization
Test ID	SCV Outlet Run 3
P <sub>bar</sub> ("Hg)	29.9
Pstatic ("H <sub>2</sub> O)	-0.25
Diameter (")	14
Oxygen %	20.9
Carbon Dioxide %	0.4

Method 2 Flow Determinations				
Clock Time	Traverse Point	ΔP ("H <sub>2</sub> O)	Stack Temperature (°F)	Square Root of ΔP ("H <sub>2</sub> O)
1025	1	0.15	114	0.3872983
	2	0.15	114	0.3872983
	3	0.145	114	0.3807887
	4	0.145	114	0.3807887
	5	0.14	114	0.3741657
	6	0.14	114	0.3741657
	1	0.135	114	0.3674235
	2	0.14	114	0.3741657
	3	0.14	114	0.3741657
	4	0.14	114	0.3741657
	5	0.14	114	0.3741657
1125	6	0.125	114	0.3535534
1608				
<i>averages</i>		<b>0.141</b>	<b>114.000</b>	<b>0.375</b>

V <sub>w(std)</sub>	<b>2.21</b>	grams
VM <sub>(std)</sub>	<b>20.54</b>	DSCF
B <sub>wo</sub>	<b>0.10</b>	
B <sub>ws</sub>	<b>9.73</b>	%
M <sub>d</sub>	<b>28.90</b>	lb/lb-mole
M <sub>s</sub>	<b>27.84</b>	lb/lb-mole
P <sub>s</sub>	<b>29.88</b>	"Hg
V <sub>s</sub>	<b>22.38</b>	FPS
A <sub>s</sub>	<b>1.07</b>	sqft
Q <sub>s</sub>	<b>1434.73</b>	ACFM
Q <sub>s (std)</sub>	<b>1189.33</b>	DSCFM
Cs(inlet)	<b>36.71</b>	PPMvd
E(inlet)	<b>0.30</b>	lbs/hr
Cs(outlet)	<b>0.00</b>	PPMvd
E(Outlet)	<b>0.00</b>	lbs/hr

Date	17-Sep
Facility	Long Island Sterilization
Unit	SCV Outlet Run 3
Meter Box ID	1
Meter γ	1.007
Meter ΔH@	1.81
Pitot ID	P4
Pitot C <sub>p</sub>	0.84

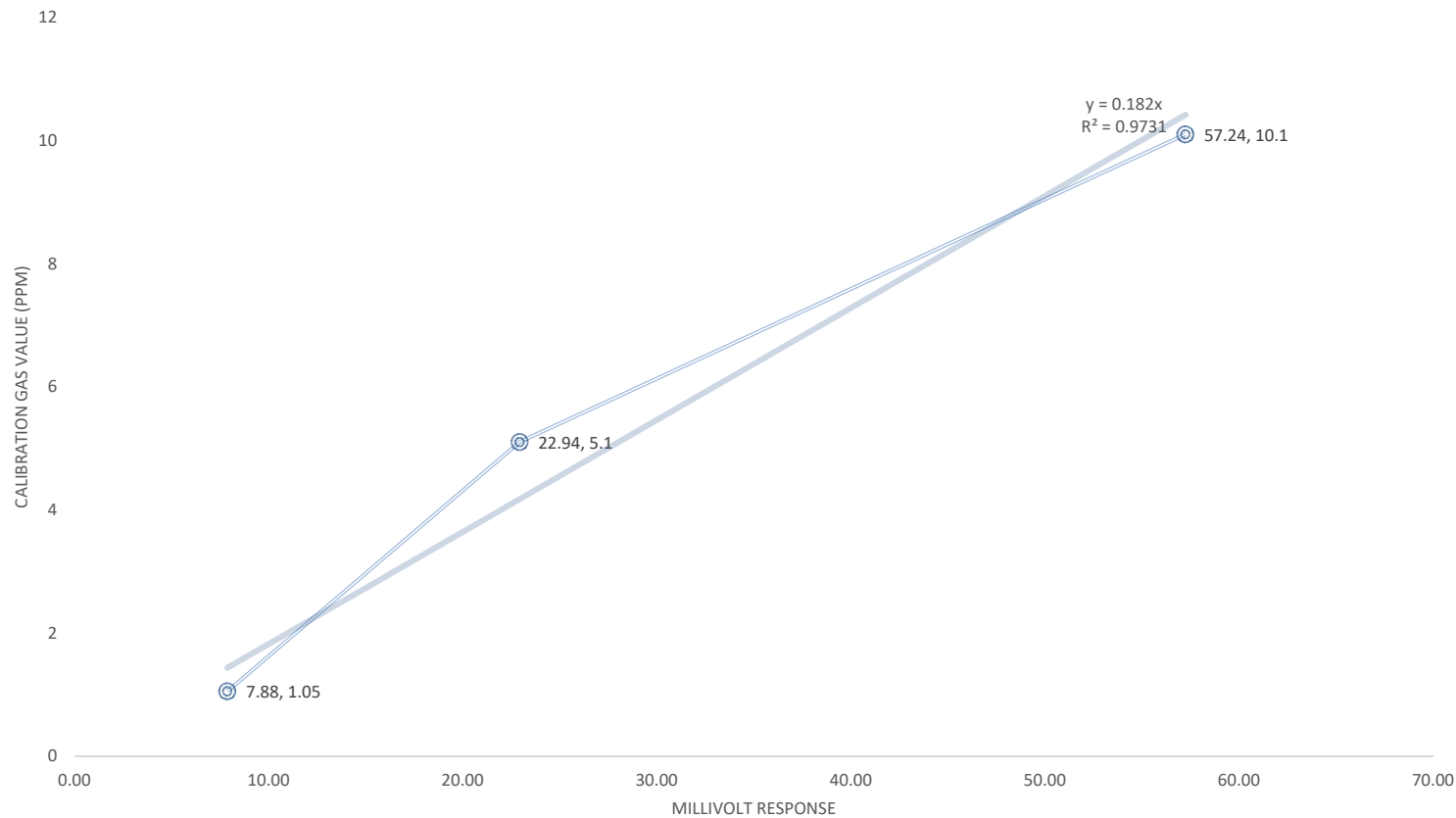
Method 4 Moisture Determinations						
Clock Time	Elapsed Time	Dry Gas Meter Displacement (DSCF)	ΔH ("H <sub>2</sub> O)	Meter Temperature (°F)	Vacuum ("Hg)	Impinger Exit Temperature (°F)
	0	0				
	5					
	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45					
	50					
	55					
	60	21	1.5	85		
<i>averages</i>		<b>21.00</b>	<b>1.50</b>	<b>85.00</b>	<b>#DIV/0!</b>	<b>#DIV/0!</b>

	Initial	Final	Difference
Impinger 1	0	0	<b>0</b>
Impinger 2	0	0	<b>0</b>
Impinger 3	0	0	<b>0</b>
Impinger 4	0	0	<b>47.05</b>
		V <sub>wc</sub>	<b>47.05</b>

Inlet	Outlet	
36.7081532	0	ppm <sub>vw</sub>
40.8	0.0	ppm <sub>vd</sub>
44.05		Molecular Weight
0.3003828	0	lbs/hr
9.730314874		Bws by Saturation

**ATTACHMENT E**  
**QA/QC CALBIRATION RECORDS.**

Long Island Sterilization, Hauppauge, NY  
Method 18 0-10.1ppm EtO Calibration Curve - GC FID  
September 17th, 2020

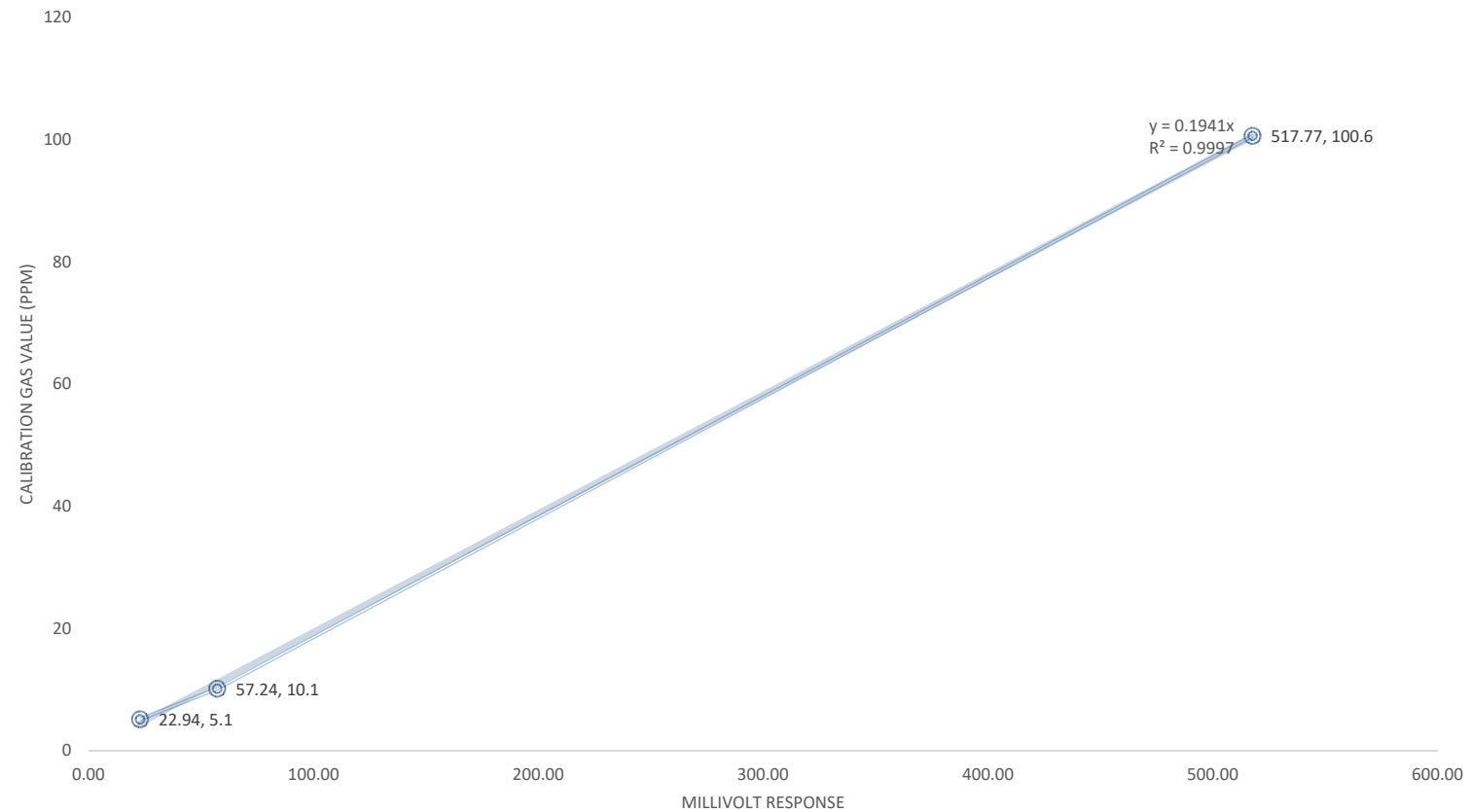


LCH Consulting Associates, LLC  
88 Glocker Way PMB 287  
Pottstown, PA 19465  
484-252-4335 phone  
info@lchconsulting.com



Long Island Sterilization, Hauppauge, NY  
Method 18 0-100.6ppm EtO Calibration Curve - GC FID  
17th, 2020

September



LCH Consulting Associates, LLC  
88 Glocker Way PMB 287  
Pottstown, PA 19465  
484-252-4335 phone  
info@lchconsulting.com

**SAMPLE BAG RECOVERY STUDY**  
Long Island Sterilization, Hauppauge, NY  
17-Sep-20

Test Date	Test Site	Run No.	Calc. Conc. EtO in Bag "u" (ppm)	Initial Spiked Bag EtO Conc. (ppm)	Conc. of Spike Added to Bag "s" (ppm)	Aged Bag EtO Conc. "t" (ppm)	R Value "R"
9/17/2020	LIS	1	0.75	2.1687	1.41	2.2958	1.0899

$$R = (t - u) / s$$

R must fall within 0.7 and 1.3

Where:

R = the average fraction recovered  
t = bag concentration after being spiked and allowed to "age"  
u = bag concentration before being spiked  
s = increase in bag concentration

Calibration Drift Assessment  
Long Island Sterilization, Hauppauge, NY  
17-Sep-20

Date	Unit Tested	Detector	Concentration EtO Standard (ppm)	Initial Response (millivolts)	Final Response (millivolts)	Calibration Drift (%)
17-Sep	AAT1	FID	5.1	22.9	22.1	3.59%



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

## **CERTIFICATE OF ANALYSIS**

**Date:** May 8, 2020  
**Order Number:** PO042520  
**Lot Number:** 304-401809610-1

**Customer:** LGH Consulting Services LLC  
**Use Before:** 05/12/2021

<b><u>Component</u></b>	<b><u>Specification (+/- 5%)</u></b>	<b><u>Analytical Result (+/- 2%)</u></b>
Ethylene Oxide	100 PPM	100.6 PPM
Nitrogen	BALANCE	BALANCE

**Cylinder Size:** 4.0 Cu. Ft.  
**Contents:** 110 Liter

**Valve:** CGA 180  
**Pressure:** 1500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

### **TECHNICAL RECOMMENDATIONS**

For best results, use the following procedure when using Reactive Gas Mixtures and always use the shortest length possible of Teflon Tubing between the Cylinder Regulator Hose Barb and the Gas Detection Instrument. Turn the regulator on before connection is made with the cylinder, allowing any trapped air to be purged from the regulator. Be sure to turn the regulator off as soon as the regulator is fully connected. Always ensure delivery tubing is compatible with the Gas. Do not store this cylinder with the regulator installed due to possible leakage or long-term reaction with internal components of the regulator. Follow instrument manufacturer's instruction manual.

**Analyst:**

*Omar Reyes*  
Omar Reyes



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

## **CERTIFICATE OF ANALYSIS**

**Date:** May 8, 2020  
**Order Number:** PO042520  
**Lot Number:** 304-401809609-1

**Customer:** LGH Consulting Services LLC  
**Use Before:** 05/12/2021

<b><u>Component</u></b>	<b><u>Specification (+/- 10%)</u></b>	<b><u>Analytical Result (+/- 2%)</u></b>
Ethylene Oxide	10 PPM	10.4 PPM
Nitrogen	BALANCE	BALANCE

**Cylinder Size:** 4.0 Cu. Ft.  
**Contents:** 110 Liter

**Valve:** CGA 180  
**Pressure:** 1500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

### **TECHNICAL RECOMMENDATIONS**

For best results, use the following procedure when using Reactive Gas Mixtures and always use the shortest length possible of Teflon Tubing between the Cylinder Regulator Hose Barb and the Gas Detection Instrument. Turn the regulator on before connection is made with the cylinder, allowing any trapped air to be purged from the regulator. Be sure to turn the regulator off as soon as the regulator is fully connected. Always ensure delivery tubing is compatible with the Gas. Do not store this cylinder with the regulator installed due to possible leakage or long-term reaction with internal components of the regulator. Follow instrument manufacturer's instruction manual.

**Analyst:**

*Omar Reyes*  
Omar Reyes



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

## **CERTIFICATE OF ANALYSIS**

**Date:** May 8, 2020  
**Order Number:** PO042520  
**Lot Number:** 304-401809608-1

**Customer:** LGH Consulting Services LLC  
**Use Before:** 05/12/2021

<b><u>Component</u></b>	<b><u>Specification (+/- 10%)</u></b>	<b><u>Analytical Result (+/- 2%)</u></b>
Ethylene Oxide	5 PPM	5.1 PPM
Nitrogen	BALANCE	BALANCE

**Cylinder Size:** 4.0 Cu. Ft.  
**Contents:** 110 Liter

**Valve:** CGA 180  
**Pressure:** 1500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

### **TECHNICAL RECOMMENDATIONS**

For best results, use the following procedure when using Reactive Gas Mixtures and always use the shortest length possible of Teflon Tubing between the Cylinder Regulator Hose Barb and the Gas Detection Instrument. Turn the regulator on before connection is made with the cylinder, allowing any trapped air to be purged from the regulator. Be sure to turn the regulator off as soon as the regulator is fully connected. Always ensure delivery tubing is compatible with the Gas. Do not store this cylinder with the regulator installed due to possible leakage or long-term reaction with internal components of the regulator. Follow instrument manufacturer's instruction manual.

**Analyst:**

*Umar Reyes*  
Umar Reyes



**GASCO AFFILIATES, LLC.**

320 Scarlet Blvd.  
Oldsmar, FL 34677  
(800) 910-0051  
fax: (866) 755-8920  
www.gascogas.com

## **CERTIFICATE OF ANALYSIS**

**Date:** May 8, 2020  
**Order Number:** PO042520  
**Lot Number:** 304-401811944-1

**Customer:** LGH Consulting Services LLC  
**Use Before:** 05/12/2021

<b>Component</b>	<b>Specification (+/- 10%)</b>	<b>Analytical Result (+/- 2%)</b>
Ethylene Oxide	1 PPM	1.05 PPM
Nitrogen	BALANCE	BALANCE

**Cylinder Size:** 4.0 Cu. Ft.  
**Contents:** 110 Liter

**Valve:** CGA 180  
**Pressure:** 1500 psig

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

### **TECHNICAL RECOMMENDATIONS**

For best results, use the following procedure when using Reactive Gas Mixtures and always use the shortest length possible of Teflon Tubing between the Cylinder Regulator Hose Barb and the Gas Detection Instrument. Turn the regulator on before connection is made with the cylinder, allowing any trapped air to be purged from the regulator. Be sure to turn the regulator off as soon as the regulator is fully connected. Always ensure delivery tubing is compatible with the Gas. Do not store this cylinder with the regulator installed due to possible leakage or long-term reaction with internal components of the regulator. Follow instrument manufacturer's instruction manual.

**Analyst:**

*Daniel Veigas*

*Daniel Veigas*